

**July
2016**

Texas Stroke Hospital Performance Measures

Stroke System of Care Report

Conducted to advance stroke reduction efforts, assess policies and practices regarding delivery of care across the state, and identify areas of opportunity for quality improvement

**Texas Cardiovascular Disease and Stroke Council
& Texas Department of State Health Services**



TABLE OF CONTENTS

EXECUTIVE SUMMARY	4
INTRODUCTION	7
BACKGROUND	7
<i>Table 1. Estimated number and unadjusted prevalence of adults, 18 years and older, that report ever having had a stroke, by race/ethnicity, Texas, 2011-2014.</i>	<i>8</i>
<i>Table 2. Age-adjusted stroke hospitalization rate per 10,000, all ages, by race/ethnicity, Texas, 2008-2013.</i>	<i>8</i>
<i>Figure 1. The 2009-2013, average age-adjusted number of deaths due to stroke per 100,000 people, all ages, by county, Texas.</i>	<i>9</i>
EVALUATING PRE-HOSPITAL CARE FOR STROKE IN TEXAS	10
<i>Figure 2. Percentage of possible stroke runs, Texas, 2014.</i>	<i>10</i>
<i>Table 3. Total number of EMS runs and possible stroke runs, Texas, by county type, 2014.</i>	<i>11</i>
<i>Table 4. Demographic characteristics among possible stroke runs, Texas, 2014.</i>	<i>11</i>
<i>Table 5. Response times among possible stroke runs, Texas, by county type, 2014.</i>	<i>12</i>
<i>Table 6. Scene times among possible stroke runs, Texas, by county type, 2014.</i>	<i>12</i>
<i>Table 7. Transport times among possible stroke runs, Texas, by county type, 2014.</i>	<i>12</i>
<i>Table 8. Total pre-hospital time among possible stroke runs, Texas, by county type, 2014.</i>	<i>13</i>
<i>Table 9. Destination type among possible stroke runs, Texas, 2014.</i>	<i>13</i>
EVALUATING HOSPITAL CARE FOR STROKE IN TEXAS	14
<i>Table 10. Site participation and reported cases per year, 2008-2015.</i>	<i>14</i>
<i>Table 11. Distribution of reported cases by stroke subtype, 2008-2015.</i>	<i>14</i>
<i>Table 12. Demographic characteristics among reported cases, 2008-2015.</i>	<i>15</i>
HOSPITAL STROKE PERFORMANCE MEASURES	16
ARRIVAL MODE.....	17
<i>Figure 3. Percent of stroke patients by mode of arrival, 2008-2015.</i>	<i>17</i>
<i>Figure 4. Mode of arrival of stroke patients, by year, 2008-2015.</i>	<i>17</i>
<i>Table 13. Mode of arrival of stroke patients, by year, 2008-2015.</i>	<i>18</i>
ADVANCE NOTIFICATION	18
<i>Figure 5. Percent of advance notification by EMS among stroke patients, 2008-2015.</i>	<i>18</i>
<i>Figure 6. Advance notification by EMS among stroke patients, by year, 2008-2015.</i>	<i>19</i>
<i>Table 14. Advance notification by EMS among stroke patients, by year, 2008-2015.</i>	<i>19</i>
NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS) REPORTED	20
<i>Figure 7. Percent of ischemic stroke and stroke not otherwise specified patients with a score reported for NIHSS (initial), 2008-2015.</i>	<i>20</i>
<i>Figure 8. Ischemic stroke and stroke not otherwise specified patients with a score reported for NIHSS (initial), by year, 2008-2015.</i>	<i>20</i>
<i>Table 15. Ischemic stroke and stroke not otherwise specified patients with a score reported for NIHSS (initial), by year, 2008-2015.</i>	<i>21</i>
TIME TO INITIAL BRAIN IMAGING	21

Figure 9. Percent of stroke patients that arrive within 3 hours with initial CT scan within 25 minutes, 2008-2015.	21
Figure 10. Stroke patients that arrive within 3 hours with initial CT scan within 25 minutes, by year, 2008-2015.	22
Table 16. Stroke patients that arrive within 3 hours with initial CT scan within 25 minutes, by year, 2008-2015.	22
TIME TO INTRAVENOUS THROMBOLYTIC THERAPY – 60 MINUTES	23
Figure 11. Percent of acute ischemic stroke patients treated with IV t-PA within 60 minutes of arrival, 2008-2015.	23
Figure 12. Acute ischemic stroke patients treated with IV t-PA within 60 minutes, by year, 2008-2015.	23
Table 17. Acute ischemic stroke patients treated with IV t-PA within 60 minutes, by year, 2008-2015.....	24
IV T-PA ARRIVE BY 2 HOUR, TREAT BY 3 HOUR	25
Figure 13. Percent of acute ischemic stroke patients that arrive within 2 hours and treated within 3 hours, 2008-2015.	25
Figure 14. Acute ischemic stroke patients that arrive within 2 hours and treated within 3 hours, by year, 2008-2015.	25
Table 18. Acute ischemic stroke patients that arrive within 2 hours and treated within 3 hours, by year, 2008-2015.	26
IV T-PA ARRIVE BY 3.5 HOUR, TREAT BY 4.5 HOUR	26
Figure 15. Percent of acute ischemic stroke patients that arrive within 3.5 hours and treated within 4.5 hours, 2008-2015.	26
Figure 16. Acute ischemic stroke patients that arrive within 3.5 hours and treated within 4.5 hours, by year, 2008-2015.	27
Table 19. Acute ischemic stroke patients that arrive within 3.5 hours and treated within 4.5 hours, by year, 2008-2015.	27
DRIP AND SHIP THERAPY	28
Table 20. Drip and Ship therapy among ischemic stroke patients, 2008-2015.	28
Figure 17. Drip and ship therapy among ischemic stroke patients, by year, 2008-2015.	28
Table 21. Drip and ship therapy among ischemic stroke patients, by year, 2008-2015.	28
ENDOVASCULAR THERAPY	29
Table 22. Ischemic stroke patients that receive endovascular therapy, 2008-2015.	29
Table 23. Endovascular therapy among ischemic stroke patients, by year, 2008-2015.	29
THROMBOLYTIC COMPLICATIONS.....	30
Figure 19. Percent of ischemic stroke patients with bleeding complications after thrombolytic therapy, 2008-2015.	30
Figure 20. Ischemic stroke patients with bleeding complications after thrombolytic therapy, by year, 2008-2015.	30
Table 24. Ischemic stroke patients with bleeding complications after thrombolytic therapy, by year, 2008-2015.	31
REHABILITATION CONSIDERED.....	31
Figure 21. Percent of stroke patients assessed for rehabilitative services prior to discharge, 2008-2015	31
Figure 22. Stroke patients assessed for rehabilitative services prior to discharge, by year, 2008-2015.....	32
Table 25. Stroke patients assessed for rehabilitative services prior to discharge, by year, 2008-2015.....	32
DISCHARGE DISPOSITION	33
Figure 23a. Discharge disposition of stroke patients, discharged on or after April 1, 2011. 23b. Discharge disposition among stroke patients discharged to Other Healthcare Facility.	33

<i>Figure 24. Discharge disposition of stroke patients, by year, 2011-2015.</i>	34
<i>Figure 25. Discharge disposition among stroke patients discharged to Other Healthcare Facility, by year, 2011-2015.</i>	34
COMORBIDITIES	35
<i>Figure 26. Medical history of atrial fibrillation, 2008-2015.</i>	36
<i>Figure 27. Medical history of diabetes mellitus, 2008-2015.</i>	36
<i>Figure 28. Prevalence of high risk lipid levels during the stroke episode of care, 2008-2015.</i>	37
<i>Figure 29. Ischemic stroke and TIA patients with a documented lipid profile, 2008-2015.</i>	37
<i>Figure 30. Medical history of dyslipidemia, 2008-2015.</i>	38
<i>Figure 31. Prevalence of dyslipidemia during the stroke episode of care, 2008-2015.</i>	38
<i>Figure 32. Medical history of hypertension, 2008-2015.</i>	39
<i>Figure 33. Prevalence of hypertension during the stroke episode of care, 2008-2015.</i>	39
<i>Figure 34. Medical history of smoking, 2008-2015.</i>	40
<i>Figure 35. Stroke patients with a history of smoking that receive smoking cessation prior to discharge, 2008-2015.</i>	40
<i>Figure 36. Medical history of overweight/obesity, 2008-2015.</i>	41
<i>Figure 37. Prevalence of BMI ≥ 25 kg/m² during the stroke episode of care, 2008-2015.</i>	41
APPENDIX	42
REFERENCES	44

EXECUTIVE SUMMARY

Between 2011 and 2014, the prevalence of stroke among Texans, 18 years of age and older, has remained somewhat steady around 2.7% (**Table 1**). In 2013, the age-adjusted hospitalization rate due to stroke among Texans of all ages was 20.7 per 10,000 people (**Table 2**). The 2013, age-adjusted stroke death rate among Texans of all ages was 40.9 per 100,000 people.

In order to advance stroke reduction efforts, it is important to analyze the system of care by collecting and analyzing data. During the 83rd Regular Texas Legislative Session, funds were appropriated to advance heart attack and stroke reduction efforts throughout Texas. To inform such efforts, the Texas Department of State Health Services (DSHS) has launched a heart attack and stroke data collection initiative.

To evaluate the care of patients diagnosed with a stroke, elements within the stroke system of care were assessed for timeliness and appropriateness. DSHS analyzed data collected from the hospitals that agreed to participate in this data collection initiative. The data is collected in the Get With The Guidelines®-Stroke database using the Quintiles PMT® system, and reflects **hospital care from the first quarter of 2008 through the fourth quarter of 2015**.

To evaluate the pre-hospital component of care for patients with a possible stroke diagnosis, select elements collected through the Texas EMS & Trauma Registries were used to capture pre-hospital performance. DSHS analyzed the data reported by Emergency Medical Service (EMS) providers to the Texas EMS & Trauma Registries, which reflects **pre-hospital care for 2014**.

Substantial pre-hospital stroke care findings, 2014:

- A total of **1,120,047** EMS 911 response runs were reported in 2014, of which **11,734** were considered possible stroke cases (Appendix) and included in the report (Table 3).
- **79.1%** of stroke runs occurred in urban counties, and **20.0%** occurred in rural counties (Table 4).
- The median response time among stroke runs in Texas was **6 minutes** (Table 5).
- The median scene time among stroke runs in Texas was **16 minutes** (Table 6).
- The median transport time among stroke runs in Texas was **11 minutes** (Table 7).
- The median total pre-hospital time among stroke runs in Texas was **36 minutes** (Table 8).
- The destination of **76.7%** of stroke cases was a hospital emergency department (Table 9).

Substantial hospital stroke care finding, 2008-2015:

- A total of **44** participating hospitals provided data on individual episodes of stroke (Table 10).
- From 2008-2015, **78,942 cases** of stroke were reported by participating hospitals (Table 11).
- Of the total episodes of stroke reported, **74,296 cases** were considered eligible for analysis and included in the report.
- **34.8%** of patients arrived at the hospital by private transportation, **41.9%** arrived by EMS (Figure 3).
 - The yearly percent trend for patients arriving by private transportation ranged from 27.2% in 2012 to 42.1% in 2008.

- The yearly percent trend for patients arriving by EMS ranged from 30.5% in 2012 to 56.0% in 2008 (Figure 4).
- EMS gave pre-notification to the receiving hospital in **53.6%** of stroke cases arriving by EMS (Figure 5).
 - The yearly percent trend for pre-notification ranged from 45.4% in 2015 to 64.0% in 2011 (Figure 6).
- **19.8%** of ischemic stroke or stroke not otherwise specified (NOS) patients did not have a National Institutes of Health Stroke Scale (NIHSS) score (initial) (Figure 7).
 - The yearly percent trend for ischemic stroke and stroke NOS patients with a NIHSS score (initial) ranged from 43.9% in 2008 to 92.9% in 2015 (Figure 8).
- **38.8%** of stroke patients that arrive at the hospital within 3 hours of time last known well (LKW) did not receive a CT scan within 25 minutes of arrival (Figure 9).
 - The yearly percent trend for patients that arrive within 3 hours with a CT scan performed within 25 minutes of arrival ranged from 39.3% in 2008 to 71.8% in 2015 (Figure 10).
- **46.6%** of IV t-PA-treated stroke patients did not receive IV t-PA within 60 minutes of hospital arrival (Figure 11).
 - The yearly percent trend for IV t-PA-treated stroke patients that received IV t-PA within 60 minutes ranged from 15.3% in 2008 to 75.8% in 2015 (Figure 12).
- **94.9%** of eligible ischemic stroke patients that arrive at the hospital within 2 hours of time LKW were treated within 3 hours of time LKW (Figure 13).
 - The yearly percent trend for eligible ischemic stroke patients that arrive within 2 hours and treated within 3 hours ranged from 90.8% in 2008 to 96.3% in 2014 (Figure 14).
- **68.1%** of eligible ischemic stroke patients that arrive at the hospital within 3.5 hours of time LKW were treated within 4.5 hours of time LKW (Figure 15).
 - The yearly percent trend for eligible ischemic stroke patients that arrive within 3 hours and treated within 4.5 hours ranged from 23.8% in 2008 to 80.7% in 2014 (Figure 16).
- **1.9%** of eligible ischemic stroke patients received drip and ship therapy (Table 21).
 - The yearly percent trend for eligible ischemic stroke patients that receive drip and ship therapy ranged from 0.5% in 2008 to 2.6% in 2015 (Figure 17).
- **4.7%** of the ischemic stroke patients that receive IV t-PA or IA catheter-based treatment experienced bleeding complications after receiving thrombolytic therapy (Figure 19).
 - The yearly percent trend for the ischemic stroke patients with bleeding complications after thrombolytic therapy ranged from 3.4% in 2010 to 6.3% in 2011 (Figure 20).
- **97.6%** of stroke patients were assessed for rehabilitative services (Figure 21).
 - The yearly percent trend for stroke patients assessed for rehabilitative services ranged from 94.7% in 2009 to 98.7% in 2014 (Figure 22).
- **52.2%** of patients were discharged home, **32.9%** were discharged to a healthcare facility (Figure 23a).
 - Among the 32.9% discharged to a healthcare facility, **58.4%** were inpatient rehabilitation facilities (IRF), and **34.5%** skilled nursing facilities (SNF) (Figure 23b).
- **65.6%** of stroke patients had a medical history of atrial fibrillation (Figure 26).
- **39.6%** of stroke patients had medical history of diabetes mellitus (Figure 27).

- **67.5%** of stroke patients had a HDL <40mg/dL, **16.3%** had a LDL ≥130mg/dL, **14.1%** had a total cholesterol >200mg/dL, and **19.5%** had a triglyceride level ≥150mg /dL measured within 48 hours of arrival or the prior 30 days (Figure 28).
- **39.9%** of stroke patients had a medical history of dyslipidemia (Figure 30).
 - **76.9%** had total cholesterol >200 mg/dL, or LDL ≥130 mg/dL, or HDL <40 mg/dL measured within 48 hours of arrival or the prior 30 days (Figure 31).
- **75.5%** of stroke patients had a medical history of hypertension (Figure 32).
 - **49.6%** had a SBP ≥140mm/Hg, and/or DBP ≥90mm/Hg measured during the stroke episode of care (Figure 33).
- **24.7%** of stroke patients had a medical history of smoking (Figure 34).
 - **64.8%** received smoking cessation counseling prior to hospital discharge (Figure 35).
- **10.5%** of stroke patients had a medical history of overweight/obesity (Figure 36).
 - **43.9%** had a BMI ≥25 kg/m² measured during the stroke episode of care (Figure 37).

INTRODUCTION

A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is blocked by a clot or ruptures, leading to death of brain cells.¹ The two most common types of stroke include ischemic stroke and hemorrhagic stroke. An ischemic stroke is caused when blood and oxygen to the brain is blocked by a clot in a blood vessel, and a hemorrhagic stroke is caused when a blood vessel ruptures, not allowing blood flow to the brain. An additional type of stroke, transient ischemic attack or TIA, is known as a “mini stroke” that is caused by a temporary clot in a blood vessel.¹

BACKGROUND

In order to advance stroke reduction efforts, it is important to assess the system of care by collecting and analyzing data. During the 83rd Regular Texas Legislative Session, funds were appropriated to advance heart attack and stroke reduction efforts throughout Texas. To inform such efforts, the Texas Department of State Health Services (DSHS) has launched a heart attack and stroke data collection initiative. The data collection initiative focuses on pre-hospital and hospital data elements. This report includes de-identified, aggregate data for hospitals who have agreed to share Get With The Guidelines® (GWTG)-Stroke data with DSHS. All data is protected under Health Insurance Portability Accountability Act (HIPAA) guidelines. No hospital level data will be distributed, nor will any hospital name be identified in the report. This aggregate data is intended to inform stakeholders about opportunities for collaboration and system improvement.

The objective of the data collection is to gain an understanding of the prevalence of stroke in Texas, evaluate pre-hospital and hospital care components, and treatment of stroke patients. The findings will be used to assess policies and practices regarding delivery of care across the state and identify areas of opportunity for quality improvement.

STROKE IN TEXAS

Table 1 displays the unadjusted prevalence of stroke per year (2011-2014), for adults 18 years of age and older in Texas, stratified by race-ethnicity. Between 2011 and 2014, the mean unadjusted prevalence of stroke among adults 18 years of age and older in Texas was 2.7%.

The unadjusted prevalence of stroke, when stratified by race-ethnicity groups, was higher among Blacks compared to White and Hispanic populations for years 2011 to 2014 (**Table 1**). In 2014, the prevalence among Blacks (5.8%) was significantly higher than Whites (3.1%) and Hispanics (1.9%).

Table 1. Estimated number and unadjusted prevalence of adults, 18 years and older, that report ever having had a stroke, by race/ethnicity, Texas, 2011-2014.

Year	Adults No.	% of Adults (95% CI)	Race/Ethnicity			
			% White only (95% CI)	% Black only (95% CI)	% Hispanic (95% CI)	% Other (95% CI)
2011	487,039	2.7 (2.3-3.0)	2.7 (2.2-3.1)	5.2 (3.2-7.2)	1.8 (1.1-2.4)	--
2012	513,211	2.7 (2.3-3.1)	3.2 (2.6-3.8)	4.2 (2.6-5.8)	1.5 (0.9-2.0)	--
2013	487,955	2.5 (2.1-2.9)	3.0 (2.5-3.6)	3.7 (2.1-5.3)	1.6 (1.0-2.2)	--
2014	587,304	3.0 (2.5-3.4)	3.1 (2.6-3.7)	5.8 (3.9-8.6)	1.9 (1.4-2.6)	--

Abbreviations: CI, confidence interval.

-- indicates data is not reportable due to small sample size.

According to the 2013 Texas Behavioral Risk Factor Surveillance System (BRFSS) survey, an estimated 86.9% of adults in Texas said they would call 911 if they thought someone was having a heart attack or stroke. The remaining 13.1% of adults said they would take other action, such as take the person to the hospital, tell the person to call their doctor, call a spouse or family member, or do something else.

Table 2 displays the age-adjusted hospitalization rates (per 10,000) for stroke among all ages in Texas, by year (2008-2013), stratified by race-ethnicity. The age-adjusted hospitalization rate for stroke (per 10,000) in Texas declined from 23.9 in 2008 to 20.7 in 2013.

Table 2. Age-adjusted stroke hospitalization rate per 10,000, all ages, by race/ethnicity, Texas, 2008-2013.

Year	Hospitalized No.	Age-Adjusted Hospitalization Rate (95% CI)	Race/Ethnicity			
			White only (95% CI)	Black only (95% CI)	Hispanic only (95% CI)	Other (95% CI)
2008	48,988	23.9 (23.7-24.1)	23.2 (23.0-23.5)	31.9 (31.1-32.7)	19.3 (18.9-19.7)	39.9 (38.4-41.4)
2009	46,973	22.3 (22.1-22.5)	21.7 (21.4-21.9)	29.5 (28.7-30.2)	18.9 (18.5-19.3)	33.0 (31.7-34.3)
2010	47,588	21.7 (21.5-21.9)	20.6 (20.3-20.8)	28.9 (28.1-29.6)	19.0 (18.6-19.4)	38.4 (36.9-39.9)
2011	49,224	21.7 (21.5-21.9)	20.4 (20.2-20.7)	30.7 (29.9-31.4)	17.9 (17.6-18.3)	32.7 (31.5-33.8)
2012	49,738	21.1 (20.9-21.2)	18.8 (18.6-19.0)	26.4 (25.8-27.1)	16.8 (16.4-17.1)	56.3 (54.8-57.8)
2013	50,500	20.7 (20.5-20.9)	19.4 (19.2-19.6)	27.5 (26.9-28.2)	17.0 (16.6-17.3)	34.9 (33.8-36.1)

Abbreviations: CI, confidence interval.

The average age-adjusted annual stroke death rate, from 2009 to 2013, was 43.4 per 100,000 people of all ages in Texas. Among race-ethnicity groups, Blacks had the highest age-adjusted stroke death rate, 61.6 per 100,000.

Figure 1 displays the geographic distribution of annual age-adjusted stroke death rates (per 100,000) among all ages in Texas from 2009 to 2013. The highest death rates appear to emerge in northern and eastern counties.

For every 100,000 people, an average of 43.4 persons died of a stroke annually in Texas from 2009 to 2013.

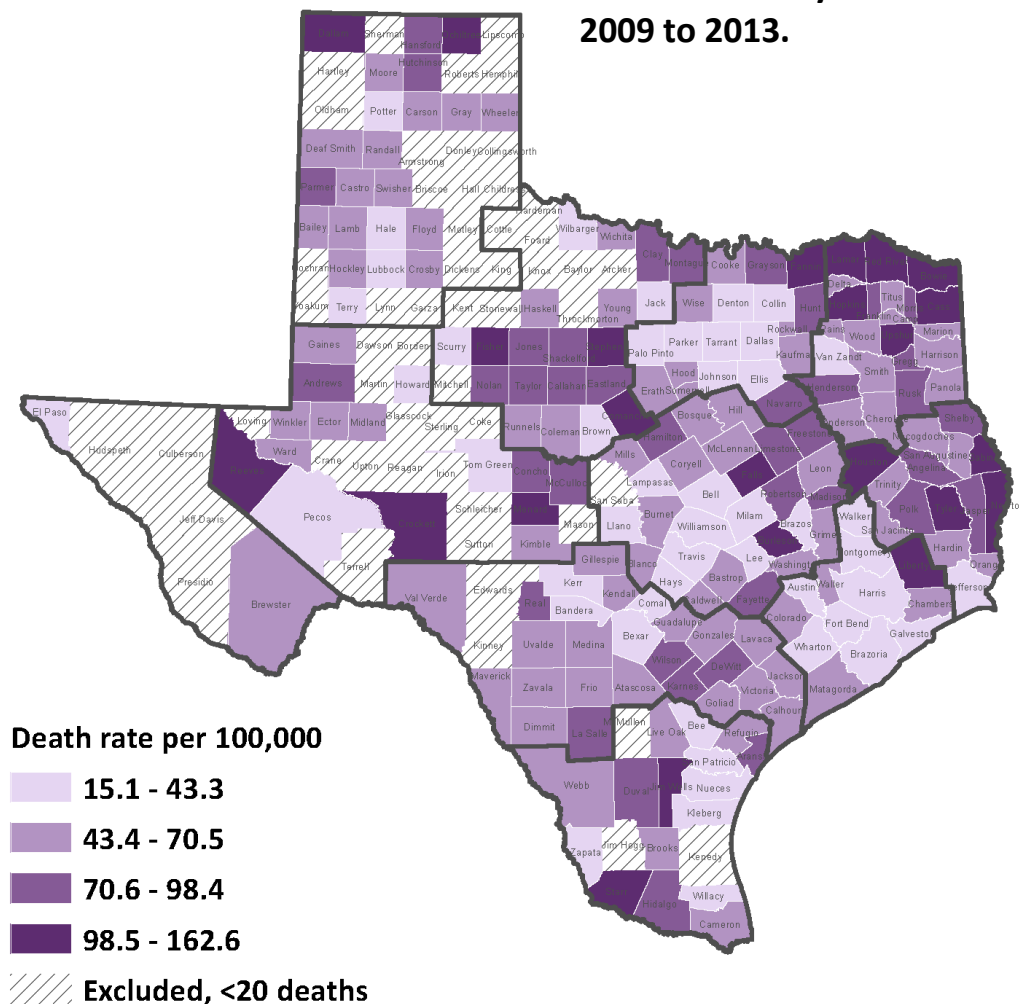


Figure 1. The 2009-2013, average age-adjusted number of deaths due to stroke per 100,000 people, all ages, by county, Texas.

EVALUATING PRE-HOSPITAL CARE FOR STROKE IN TEXAS

The objective of collecting pre-hospital data is to gain an understanding and evaluate the pre-hospital care component of stroke in Texas. The findings will be used to assess policies and practices regarding delivery of care across the state and identify areas of opportunity for quality improvement. The data reported by Emergency Medical Service (EMS) providers, collected through the Texas EMS & Trauma Registries reflects pre-hospital care for 2014.

The pre-hospital measures included in this report are specific to the data collected in 2014 through the Texas EMS & Trauma Registries. The inclusion/exclusion criteria used to determine a possible stroke run is exclusive to this report and the 2014 data. For the purpose of this report and the following pre-hospital performance measures, a possible stroke run is defined as; a 911 emergency response with the primary symptom reported as “Stroke/Cerebrovascular Accident (CVA)” (Appendix).

The report includes the following pre-hospital measures for stroke;

1. Response Time
2. Scene Time
3. Transport Time
4. Total Pre-Hospital Time
5. Destination Type

POSSIBLE STROKE RUNS

The total number of reported 911 response runs for incidents that occurred in Texas, among adults 18 years and older, in 2014 was 1,120,047 (**Table 3**). Among the total number of runs (1,120,047), 1.0% (11,734) had the primary symptom reported as “Stroke/CVA” and thus considered the total number of possible stroke runs for the purpose of this report (**Figure 2**).

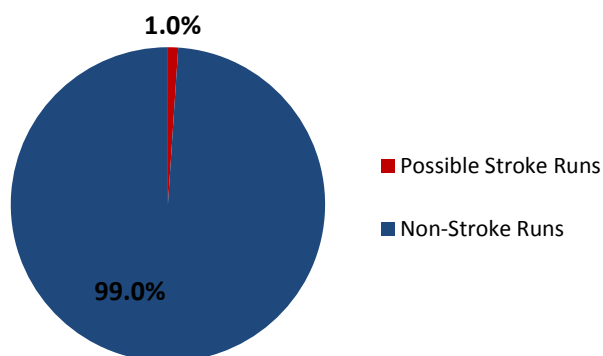


Figure 2. Percentage of possible stroke runs, Texas, 2014.

Table 3. Total number of EMS runs and possible stroke runs, Texas, by county type, 2014.

Incident Location	Total EMS Runs* (N)	Total Possible Stroke Runs* (n)	Percent Possible Stroke Runs* %
Texas	1,120,047	11,734	1.0
Urban county**	897,725	9,281	1.0
Rural county**	177,149	2,348	1.3
Missing	45,173	105	0.2

*see appendix for inclusion/exclusion criteria for EMS runs and possible stroke runs

**see appendix for urban-rural classification

Table 4 displays the demographic characteristics of the 11,734 possible stroke runs reported for 2014. Women accounted for a little over half (52.9%), the median age is 71, with 45.5% of cases between the ages of 66 to 85, with the majority of runs occurring in urban counties (79.1%).

Table 4. Demographic characteristics among possible stroke runs, Texas, 2014.

Demographics	Possible Stroke Runs* n=11,734	Percent Possible Stroke Runs* %
<u>Gender</u>		
Female	6,211	52.9
Male	5,485	46.7
Unknown	38	0.3
<u>Age (years)</u>		
18 – 45	1,010	8.6
46 – 65	3,598	30.7
66 – 85	5,338	45.5
>85	1,788	15.2
<u>County Type</u>		
Urban**	9,281	79.1
Rural**	2,348	20.0
Missing	105	0.9

*see appendix for inclusion/exclusion criteria for possible stroke runs

**see appendix for urban-rural classification

RESPONSE TIME

Response time is the time interval from when the responding unit was notified by dispatch to the time the responding unit arrived on the scene. The median response time among possible stroke runs in Texas was 6 minutes (**Table 5**).

Table 5. Response times among possible stroke runs, Texas, by county type, 2014.

Incident Location	Possible Stroke Runs* (n)	Average Response Time (min:sec)	Median Response Time (min)	90th Percentile Response Time (min)
Texas	11,587	8:50	6	15
Urban county**	9,168	8:13	6	13
Rural county**	2,317	11:13	7	23

*see appendix for inclusion/exclusion criteria for possible stroke runs

**see appendix for urban-rural classification

SCENE TIME

Scene time is the time interval from when the responding unit arrived on the scene to the time the responding unit left the scene with a patient. The median scene time among possible stroke runs in Texas was 16 minutes (**Table 6**).

Table 6. Scene times among possible stroke runs, Texas, by county type, 2014.

Incident Location	Possible Stroke Runs* (n)	Average Scene Time (min:sec)	Median Scene Time (min)	90th Percentile Scene Time (min)
Texas	11,371	17:53	16	26
Urban county**	8,993	17:57	16	26
Rural county**	2,275	17:44	16	26

*see appendix for inclusion/exclusion criteria for possible stroke runs

**see appendix for urban-rural classification

TRANSPORT TIME

Transport time is the time interval from when the stroke patient left the scene in an ambulance to the time the patient arrived at the destination or transfer point. The median transport time among possible stroke runs in Texas was 11 minutes (**Table 7**).

Table 7. Transport times among possible stroke runs, Texas, by county type, 2014.

Incident Location	Possible Stroke Runs* (n)	Average Transport Time (min:sec)	Median Transport Time (min)	90th Percentile Transport Time (min)
Texas	10,954	16:37	11	30
Urban county**	8,667	15:51	11	26
Rural county**	2,186	19:34	12	44

*see appendix for inclusion/exclusion criteria for possible stroke runs

**see appendix for urban-rural classification

TOTAL PRE-HOSPITAL TIME

The total pre-hospital time is the time interval from when the responding unit was notified by dispatch to the time the responding unit arrived with the patient at the destination or transfer point. The median total pre-hospital time among possible stroke runs in Texas was 36 minutes (**Table 8**).

Table 8. Total pre-hospital time among possible stroke runs, Texas, by county type, 2014.

Incident Location	Possible Stroke Runs* (n)	Average Pre-Hospital Time (min:sec)	Median Pre-Hospital Time (min)	90 th Percentile Pre-Hospital Time (min)
Texas	11,039	41:33	36	62
Urban county**	8,732	40:13	35	56
Rural county**	2,206	46:45	39	79

*see appendix for inclusion/exclusion criteria for stroke runs

**see appendix for urban/rural classification

DESTINATION TYPE

Table 9 displays the distribution of possible stroke runs by type of destination the patient was delivered or transferred to. The most common destination type among possible stroke runs in 2014 was hospital emergency department, 76.7% (8,996).

Table 9. Destination type among possible stroke runs, Texas, 2014.

Destination	Possible Stroke Runs* n=11,734	Percent Possible Stroke Runs* %
Hospital Emergency Department	8,996	76.7
Hospital Inpatient Bed	991	8.5
Other EMS Responder Ground	61	0.5
Nursing/Assisted Living Facility	60	0.5
Medical Office Clinic	42	0.4
Other EMS Responder Air	22	0.2
Home	10	0.1
Other	464	4.0
Not Applicable	791	6.7
Not Recorded	297	2.5

*see appendix for inclusion/exclusion criteria for possible stroke runs

PRE-HOSPITAL DEATHS

The number of pre-hospital deaths is determined by the patient disposition documented by EMS. In 2014, there were fewer than 5 pre-hospital deaths among possible stroke runs.

EVALUATING HOSPITAL CARE FOR STROKE IN TEXAS

In an ideal system of care, all patients should receive proper care with minimal delays to treatment. To evaluate the care of patients diagnosed with a stroke, elements of care were assessed for timeliness and appropriateness.

DSHS evaluated data collected from a group of hospitals that agreed to participate in this data collection initiative. The data is collected in the Get With The Guidelines®-Stroke database using the Quintiles PMT® system, and reflects hospital care from the **first quarter of 2008 through the fourth quarter of 2015**.

Table 10 reflects the number of hospitals that agreed to participate and the total number of reported cases by participating hospitals each year. A total of 78,942 individual episodes of stroke care were reported from 2008 through 2015.

Table 10. Site participation and reported cases per year, 2008-2015.

Year	Participating sites	Reported cases
	No.	N=78,942
2008	19	4,517
2009	25	5,990
2010	31	7,924
2011	34	9,017
2012	38	10,338
2013	41	12,368
2014	44	13,541
2015	44	15,247

Table 11 displays the distribution of reported cases by subtype of stroke. From 2008-2015, ischemic stroke accounted for 65.2% of all reported cases. Among the other stroke types reported, 14.3% were transient ischemic attack (TIA), 10.5% intracerebral hemorrhage (ICH), and 3.8% were subarachnoid hemorrhage (SAH).

Table 11. Distribution of reported cases by stroke subtype, 2008-2015.

Stroke Type	Reported cases	Percent of reported cases
	N=78,942	%
Ischemic Stroke	51,503	65.2
Transient Ischemic Attack (<24hrs)	11,273	14.3
Intracerebral Hemorrhage	8,309	10.5
Subarachnoid Hemorrhage	2,962	3.8
Stroke not otherwise specified	1,016	1.3
Elective Carotid Intervention only	2,648	3.4
No stroke related diagnosis	984	1.3
Missing	247	0.3

Table 12 displays the demographic characteristics of the patients for 78,942 cases reported from 2008 through 2015. Women accounted for slightly over half, 51.1% of the patient population. The median age of patients was 68 years, with patients 66 to 85 years of age accounting for 44.6% of patients.

Table 12. Demographic characteristics among reported cases, 2008-2015.

Demographics	Reported cases N=78,942	Percent of reported cases %
<u>Gender</u>		
Female	40,320	51.1
Male	38,508	48.8
Missing	114	0.1
<u>Age (years)</u>		
< 18	162	0.2
18 – 45	5,877	7.4
46 – 65	28,666	36.3
66 – 85	35,186	44.6
> 85	9,051	11.5
<u>Race</u>		
White	60,213	76.3
Black or African American	12,592	16.0
Asian	968	1.2
American Indian/Alaskan Native	191	0.2
Native Hawaiian/Pacific Islander	77	0.1
Unable to determine (UTD)	4,680	5.9
Other	64	0.1
Missing	157	0.2
<u>Ethnicity</u>		
Hispanic	19,393	24.6
Non-Hispanic	59,363	75.2
Missing	186	0.2
<u>Health Insurance Status</u>		
Health insurance	53,975	68.4
Without health insurance	9,712	12.3
Missing	15,255	19.3

HOSPITAL STROKE PERFORMANCE MEASURES

The following tables and figures display the data for specific reporting, quality, and achievement measures for effective care of stroke patients. Yearly percent trends (2008 – 2015) are also included for each of the measures of effective care for stroke patients. Additional information, including data sources, inclusion criteria, and exclusion criteria, can be found in the Appendix. This report includes the following hospital performance measures for stroke:

1. Arrival Mode
2. Advance Notification
3. National Institutes of Health Stroke Scale (NIHSS) Reported
4. Time to Initial Brain Imaging
5. Time to Intravenous Thrombolytic Therapy – 60 Minutes
6. IV t-PA Arrive by 2 Hour, Treat by 3 Hour
7. IV t-PA Arrive by 3.5 Hour, Treat by 4.5 Hour
8. Drip and Ship Therapy
9. Endovascular Therapy
10. Thrombolytic Complications
11. Rehabilitation Considered
12. Discharge Disposition

ARRIVAL MODE

Time to treatment can have a significant effect on stroke patient survival rate and potential disability. For that reason, the mode of arrival for stroke patients is important to evaluate. Transport protocols should be in place for Emergency Medical Services (EMS) transport to take suspected stroke patients to the hospital with the appropriate level of stroke care, whereas patients who arrive by private vehicle may be taken to a hospital that does not meet their medical and treatment needs.²

From 2008-2015, the most common mode of hospital arrival among stroke patients was EMS from home or scene (41.9%), followed by private transport/taxi/other from home or scene (34.8%), and transferred from other hospital (12.1%) (**Figure 3**).

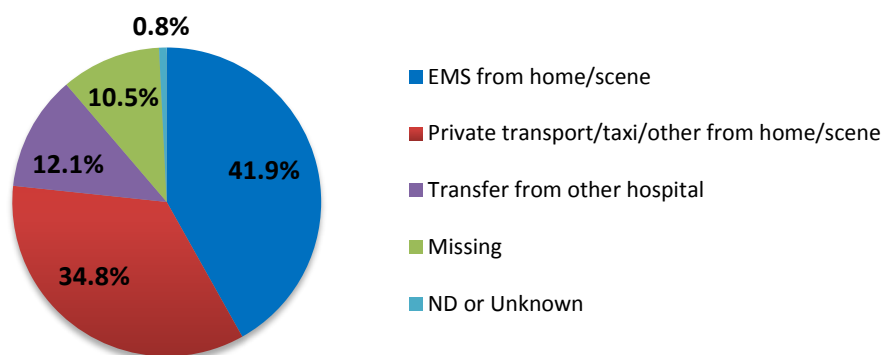


Figure 3. Percent of stroke patients by mode of arrival, 2008-2015.

Figure 4 and **Table 13** display the yearly percentage trends of stroke patient's mode of hospital arrival for 2008-2015.

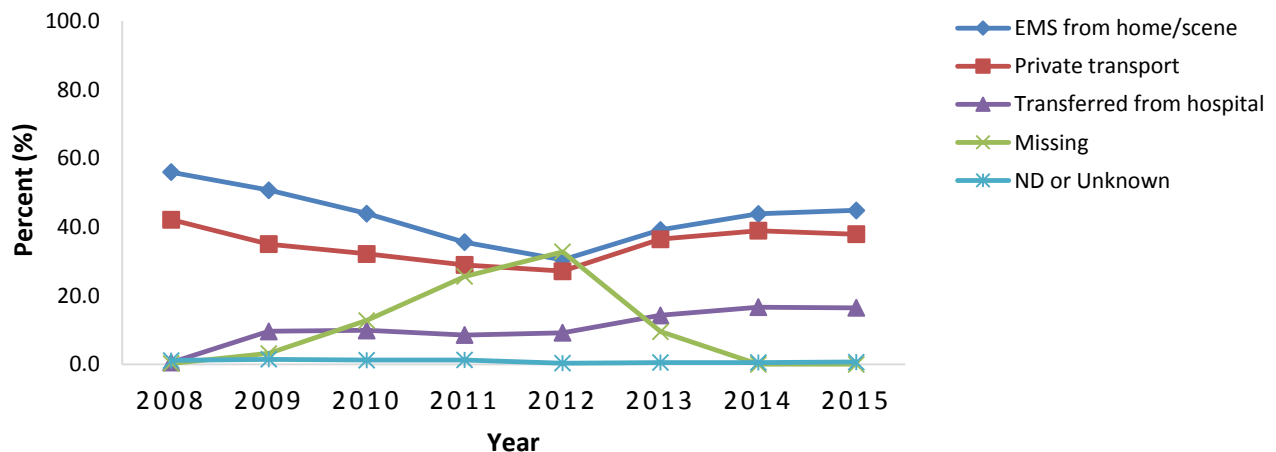


Figure 4. Mode of arrival of stroke patients, by year, 2008-2015.

Table 13. Mode of arrival of stroke patients, by year, 2008-2015.

Year	Stroke cases	Arriving via EMS	Arriving via Private Transport	Transferred from other hospital	Missing arrival mode	ND or Unknown	Reporting Hospitals
	N=74,296	n=31,102 (%)	n=25,862 (%)	n=8,971 (%)	n=7,769 (%)	n=592 (%)	No.
2008	4,495	2,517 (56.0)	1,894 (42.1)	23 (0.5)	11 (0.2)	50 (1.1)	19
2009	5,935	3,010 (50.7)	2,079 (35.0)	570 (9.6)	189 (3.2)	87 (1.5)	25
2010	7,723	3,391 (43.9)	2,486 (32.2)	765 (9.9)	986 (12.8)	95 (1.2)	31
2011	8,776	3,125 (35.6)	2,543 (29.0)	749 (8.5)	2,249 (25.3)	110 (1.3)	34
2012	9,927	3,024 (30.5)	2,697 (27.2)	915 (9.2)	3,256 (32.8)	35 (0.4)	38
2013	11,278	4,421 (39.2)	4,114 (36.5)	1,611 (14.3)	1,074 (9.5)	58 (0.5)	41
2014	12,283	5,386 (43.9)	4,784 (39.0)	2,049 (16.7)	1 (0.0)	63 (0.5)	44
2015	13,879	6,228 (44.9)	5,265 (37.9)	2,289 (16.5)	3 (0.0)	94 (0.7)	44

Between 2008 and 2015, the number of hospitals reporting on arrival mode increased each year, from 19 in 2008 to all 44 participating hospitals in 2014 and 2015. The yearly percent trend for patients arriving by EMS ranged from a low of 30.5% in 2012 to a high of 56.0% in 2008. Arrival by private transportation ranged from 27.2% in 2012 to 42.1% in 2008. Percentage of patients transferred from another hospital increased substantially from 0.5% in 2008 to 16.5% in 2015.

Opportunity exists in identifying why Texans continue to rely heavily on private transport to the hospital. With aims to increase utilization of EMS transport, identification of barriers to the use of EMS transportation is necessary.

ADVANCE NOTIFICATION

A stroke alert protocol should be in place that requires EMS technicians to alert the receiving hospital of suspected stroke patients. EMS acts as the point of first contact, providing critical time information, such as symptom onset and time last known well (LKW), potentially improving arrival to treatment times.

From 2008-2015, among stroke patients with arrival mode EMS from home/scene, 53.6% had advance notification by EMS, while 32.8% had no notification given prior to hospital arrival (**Figure 5**).

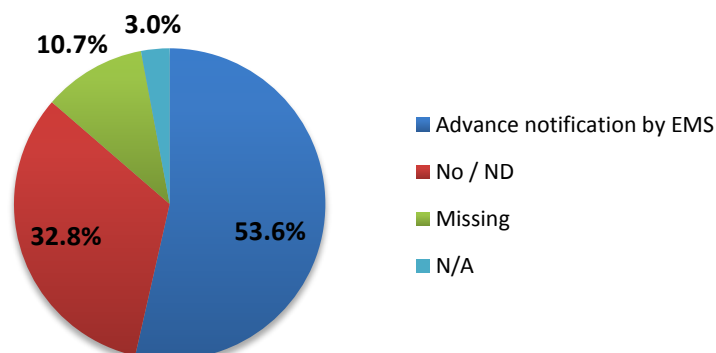


Figure 5. Percent of advance notification by EMS among stroke patients, 2008-2015.

Figure 6 and **Table 14** display the percentage of stroke patients whose mode of arrival was EMS from home/scene and advance notification was provided by EMS by year.

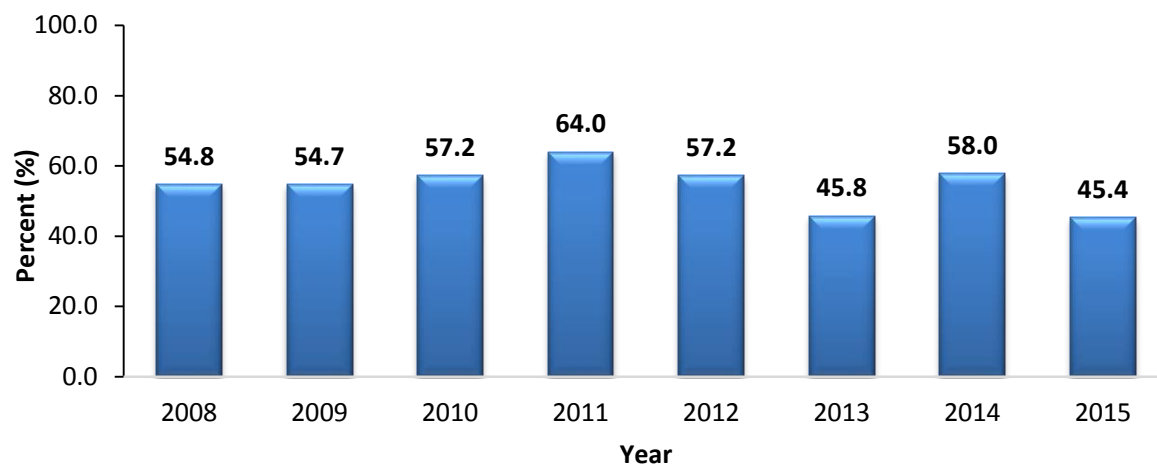


Figure 6. Advance notification by EMS among stroke patients, by year, 2008-2015.

Table 14. Advance notification by EMS among stroke patients, by year, 2008-2015.

Year	Stroke cases arriving via EMS N=31,102	Stroke cases with advance notification n=16,665	Percent stroke cases with advance notification %	Reporting Hospitals No.
2008	2,517	1,379	54.8	18
2009	3,010	1,646	54.7	25
2010	3,391	1,940	57.2	30
2011	3,125	1,999	64.0	30
2012	3,024	1,731	57.2	33
2013	4,421	2,023	45.8	41
2014	5,386	3,121	58.0	44
2015	6,228	2,826	45.4	44

Between 2008 and 2015, the number of hospitals reporting on this measure increased each year, from 18 in 2008 to 44 participating hospitals in 2014 and 2015. The yearly percent trend varied, ranging from a low of 45.4% in 2015 to a high of 64.0% in 2011. The under-utilization of EMS pre-notification remains a challenge in providing optimum care.

The lack of advance notification by EMS prior to hospital arrival is a missed opportunity and indicates a gap in the stroke system of care. Identifying the cause of under-utilization and potential barriers to use of pre-notification by EMS is needed. Opportunity exists to standardize the use of EMS stroke alert protocol across all hospital systems.

NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS) REPORTED

When a potential stroke patient arrives at a hospital, an initial neurological examination should be conducted as a component for determining diagnosis of stroke and further care. The NIHSS is a standardized neurologic examination tool commonly used to evaluate and document the patient's status. The NIHSS allows healthcare providers to easily quantify the degree of neurological deficits and severity, and identify the most appropriate treatment and level of care.²

From 2008-2015, 19.8% of patients with a diagnosis of ischemic or stroke not otherwise specified (NOS) did not have a NIHSS evaluation performed and/or initial score reported (**Figure 7**). The NIHSS performed as part of the initial examination with a resulting score was documented in 80.2% of eligible patients.

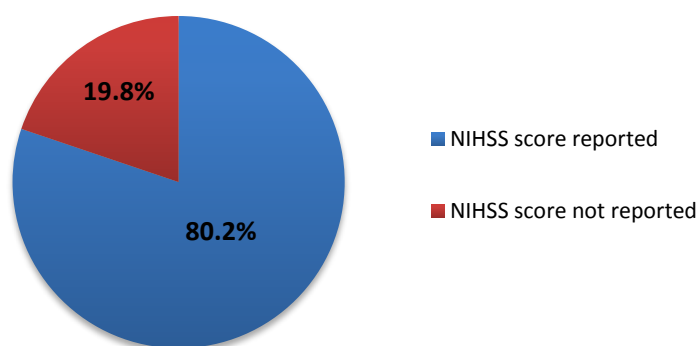


Figure 7. Percent of ischemic stroke and stroke not otherwise specified patients with a score reported for NIHSS (initial), 2008-2015.

Figure 8 and **Table 15** below display the percent of ischemic stroke and stroke NOS patients with a NIHSS score reported by year.

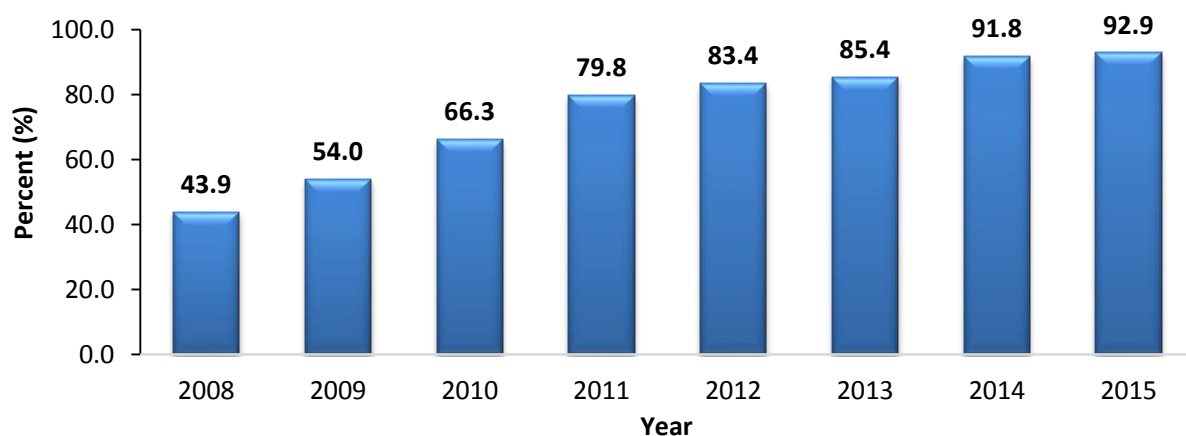


Figure 8. Ischemic stroke and stroke not otherwise specified patients with a score reported for NIHSS (initial), by year, 2008-2015.

Table 15. Ischemic stroke and stroke not otherwise specified patients with a score reported for NIHSS (initial), by year, 2008-2015.

Year	Ischemic stroke & stroke NOS cases	NIHSS score reported	Percent NIHSS score reported	Reporting Hospitals
	N=48,880	n=39,197	%	No.
2008	2,865	1,257	43.9	18
2009	3,590	1,938	54.0	25
2010	5,103	3,381	66.3	31
2011	5,975	4,769	79.8	34
2012	6,586	5,492	83.4	38
2013	7,340	6,269	85.4	40
2014	8,265	7,584	91.8	44
2015	9,156	8,507	92.9	44

Between 2008 and 2015, the number of hospitals reporting on this measure increased each year, from 18 in 2008 to 44 participating hospitals in 2014 and 2015. The percent of eligible patients with a diagnosis of ischemic stroke or stroke NOS who received an NIHSS initial evaluation also increased each year from 43.9% in 2008 to 92.9% in 2015. Opportunities exist for improving the standardization of NIHSS use and score reporting across all hospital systems.

TIME TO INITIAL BRAIN IMAGING

Brain imaging or computerized tomography (CT) scan is used to identify the type and acuity of a stroke and to locate the blockage or clot.¹ A timely initial CT scan is vital to providing effective treatment for a stroke patient. A CT scan should be performed within 25 minutes of hospital arrival and interpreted within 45 minutes of arrival.²

Among eligible patients who arrived to the hospital within 3 hours of time LKW (13,734), 38.8% did not receive a CT scan within 25 minutes of arrival (**Figure 9**).

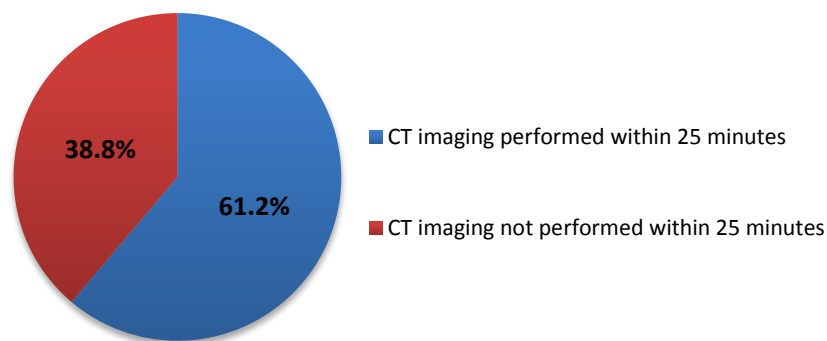


Figure 9. Percent of stroke patients that arrive within 3 hours with initial CT scan within 25 minutes, 2008-2015.

Figure 10 and **Table 16** display the percent of stroke patients who arrived within 3 hours of time LKW and initial CT scan performed within 25 minutes of hospital arrival by year.

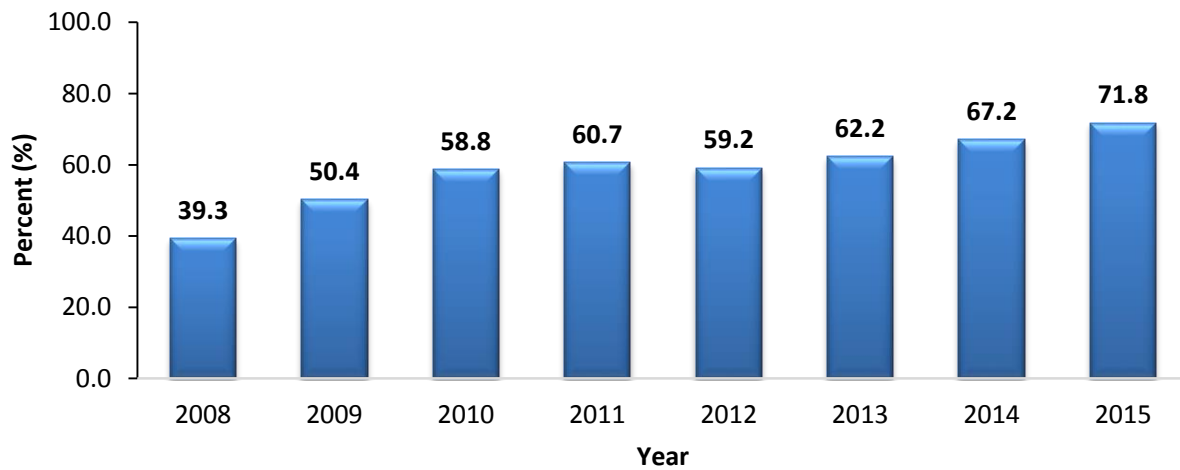


Figure 10. Stroke patients that arrive within 3 hours with initial CT scan within 25 minutes, by year, 2008-2015.

Table 16. Stroke patients that arrive within 3 hours with initial CT scan within 25 minutes, by year, 2008-2015.

Year	Stroke cases N=13,734	CT scan within 25 minutes n=8,400	Percent with CT within 25 minutes %	Reporting Hospitals No.
2008	852	335	39.3	16
2009	1,193	601	50.4	23
2010	1,610	946	58.8	31
2011	1,754	1,064	60.7	33
2012	1,880	1,112	59.2	37
2013	2,017	1,255	62.2	41
2014	2,005	1,347	67.2	43
2015	2,423	1,740	71.8	44

Between 2008 and 2015, the number of hospitals reporting on this measure increased each year, from 16 in 2008 to 44 participating hospitals in 2015. Among eligible patients who arrived to the hospital within 3 hours of time LKW, and had an initial CT scan performed within 25 minutes of hospital arrival ranged from a low of 39.3% in 2008 to a high of 71.8% in 2015. Opportunities exist for hospitals to reduce the time from emergency department (ED) arrival to initial brain imaging to promote timely and effective stroke treatment.

TIME TO INTRAVENOUS THROMBOLYTIC THERAPY – 60 MINUTES

Thrombolytic therapy using intravenous tissue plasminogen activator (IV t-PA) is the preferred reperfusion strategy for eligible patients with acute ischemic stroke caused by a clot blocking a blood vessel.³ Time to IV t-PA therapy, often referred to as door-to-needle time, is a significant measure of hospitals quality that encompasses multiple elements of the stroke system of care; time of symptom onset, first medical contact, hospital arrival, initial CT scan, and interpretation of CT scan. IV t-PA therapy should be administered within 60 minutes of hospital arrival for eligible acute ischemic stroke patients.²

Among acute ischemic stroke patients treated with IV t-PA, 53.4% received IV t-PA within 60 minutes, while 46.6% did not receive IV t-PA within 60 minutes of hospital arrival (**Figure 11**).

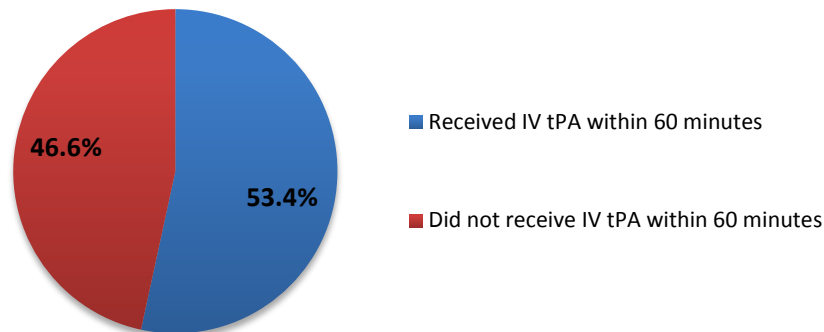


Figure 11. Percent of acute ischemic stroke patients treated with IV t-PA within 60 minutes of arrival, 2008-2015.

Figure 12 and **Table 17** display the acute ischemic stroke patients who received IV t-PA within 60 minutes of hospital arrival by year.

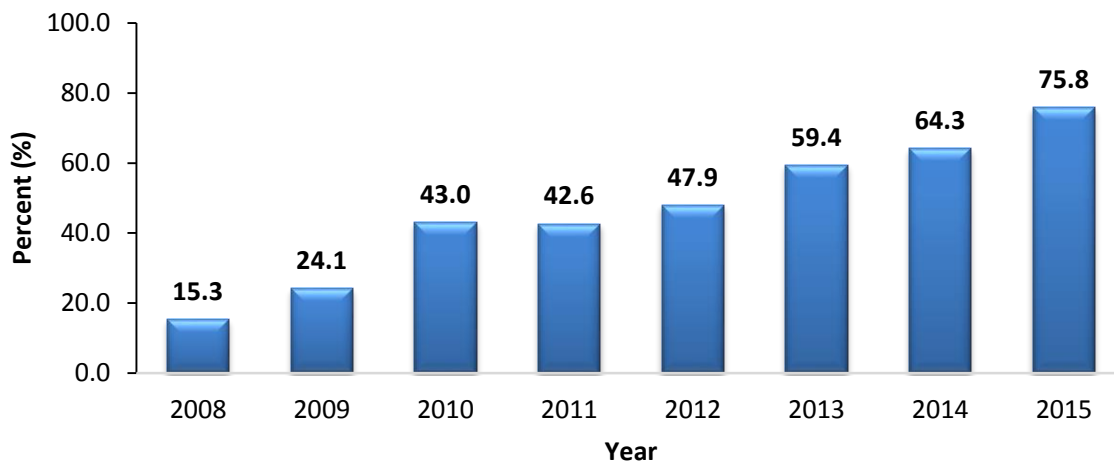


Figure 12. Acute ischemic stroke patients treated with IV t-PA within 60 minutes, by year, 2008-2015.

Table 17. Acute ischemic stroke patients treated with IV t-PA within 60 minutes, by year, 2008-2015.

Year	Acute ischemic stroke cases treated with IV t-PA	Treated with IV t-PA ≤ 60 minutes	Percent Treated with IV t-PA ≤ 60 minutes	Reporting Hospitals
	N=4,281	n=2,284	%	No.
2008	137	21	15.3	12
2009	290	70	24.1	19
2010	505	217	43.0	28
2011	631	269	42.6	32
2012	607	291	47.9	32
2013	623	370	59.4	39
2014	711	457	64.3	42
2015	777	589	75.8	40

Between 2008 and 2015, the number of hospitals reporting on this measure increased, from 12 in 2008 to 42 in 2014. The reporting declined in 2015 to 40 hospitals. Among eligible patients, the percent that received IV t-PA within 60 minutes of hospital arrival ranged from a low of 15.3% in 2008 to a high of 75.8% in 2015. The proportion of acute ischemic stroke patients treated with IV t-PA within 60 minutes of hospital arrival has increased each year. However, overall from 2008 through 2015, nearly half (46.6%) of IV t-PA-treated patients were not treated within this recommended time beneficial to patient outcomes.

The results for this quality measure indicates a gap in the system of care for acute ischemic stroke patients across participating hospitals. This indicates the need for standardization of protocols and implementation of best practices for the care of acute ischemic stroke patients across hospital systems.

IV t-PA ARRIVE BY 2 HOUR, TREAT BY 3 HOUR

A critical component when evaluating a stroke patient is identifying the time last known well (LKW), or the time at which a patient was last known to be without signs and symptoms of a stroke. Acute ischemic stroke patients, who arrive at the hospital within 2 hours of time LKW, should be treated within 3 hours of time LKW.²

Among acute ischemic stroke patients whose time of arrival is within 2 hours of time LKW, 94.9% received IV t-PA within 3 hours, while 5.1% did not receive IV t-PA within the recommended 3 hours (**Figure 13**).

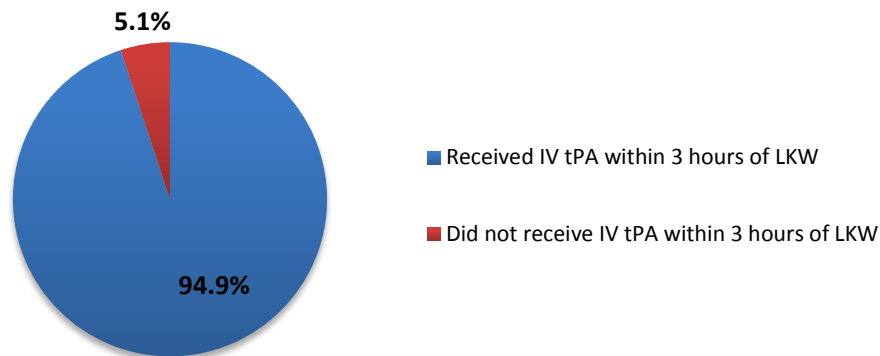


Figure 13. Percent of acute ischemic stroke patients that arrive within 2 hours and treated within 3 hours, 2008-2015.

Figure 14 and **Table 18** represent the acute ischemic stroke patients who arrived at the hospital within 2 hours of time LKW and were treated with IV t-PA within 3 hours of time LKW by year.

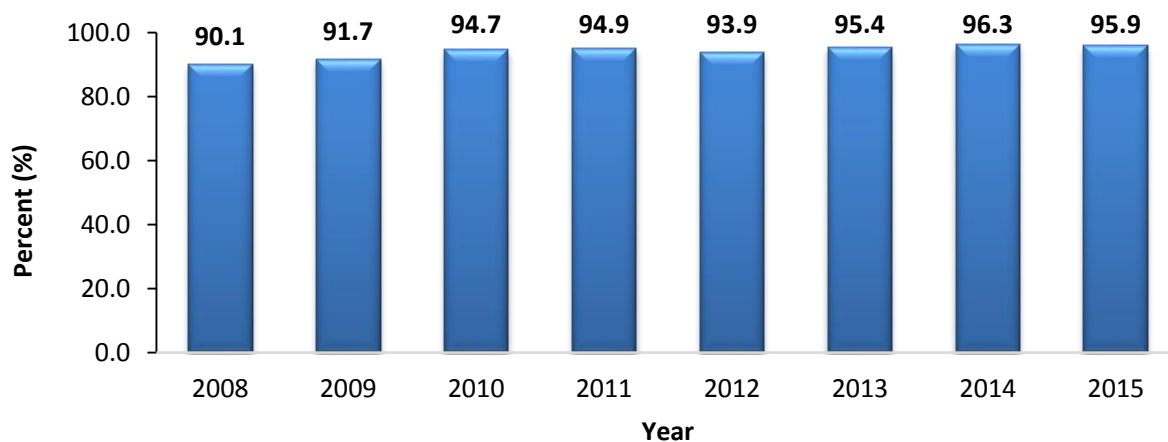


Figure 14. Acute ischemic stroke patients that arrive within 2 hours and treated within 3 hours, by year, 2008-2015.

Table 18. Acute ischemic stroke patients that arrive within 2 hours and treated within 3 hours, by year, 2008-2015.

Year	Acute ischemic stroke cases that arrive ≤2 hours	Treated with IV t-PA ≤ 3 hours	Percent treated with IV t-PA ≤ 3 hours	Reporting Hospitals
	n=3,968	n=3,766	%	No.
2008	131	118	90.1	12
2009	253	232	91.7	19
2010	430	407	94.7	28
2011	513	487	94.9	32
2012	561	527	93.9	35
2013	612	584	95.4	38
2014	709	683	96.3	43
2015	759	728	95.9	41

Between 2008 and 2015, the number of hospitals reporting for this measure increased, from 12 in 2008 to 43 in 2014. The reporting declined in 2015 to 41 hospitals. The percent of eligible patients who arrived at the hospital within 2 hours of time LKW and were treated with IV t-PA within 3 hours of time LKW ranged increased each year, and ranged from 90.8% in 2008 to 96.3% in 2014.

IV t-PA ARRIVE BY 3.5 HOUR, TREAT BY 4.5 HOUR

Acute ischemic stroke patients, who arrive at the hospital within 3.5 hours of time LKW and are eligible for IV t-PA therapy, should be treated with IV t-PA within 4.5 hours of time LKW.²

Among eligible acute ischemic stroke patients who arrived at the hospital within 3.5 hours of time LKW, 68.1% received IV t-PA treatment within 4.5 hours, while 31.9% of IV t-PA treatment was not initiated within the recommended 4.5 hours from time LKW (**Figure 15**).

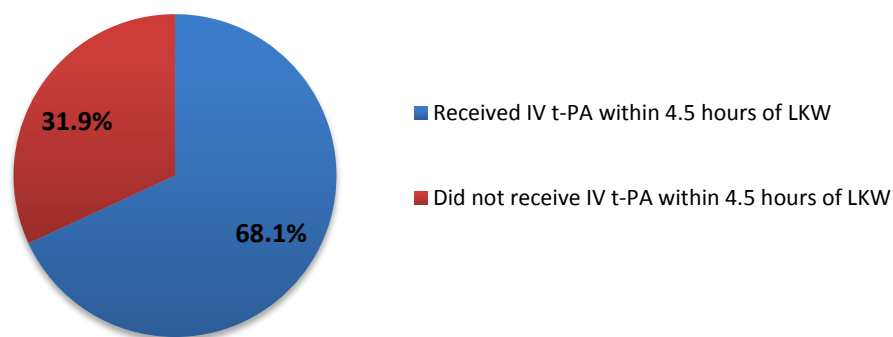


Figure 15. Percent of acute ischemic stroke patients that arrive within 3.5 hours and treated within 4.5 hours, 2008-2015.

Figure 16 and **Table 19** represent the acute ischemic stroke patients who arrive at the hospital within 3.5 hours of time LKW and treated with IV t-PA within 4.5 hours of time LKW by year.

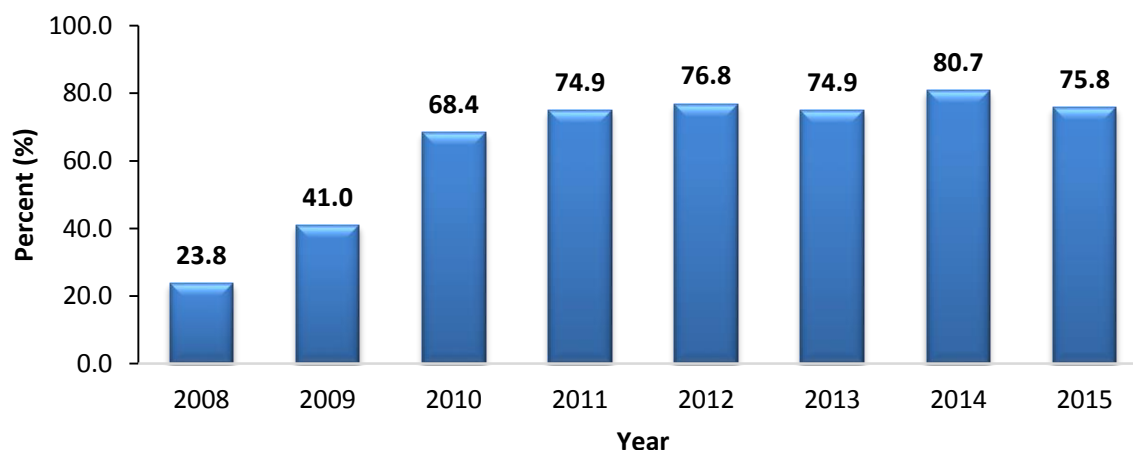


Figure 16. Acute ischemic stroke patients that arrive within 3.5 hours and treated within 4.5 hours, by year, 2008-2015.

Table 19. Acute ischemic stroke patients that arrive within 3.5 hours and treated within 4.5 hours, by year, 2008-2015.

Year	Acute ischemic stroke cases that arrive ≤3.5 hours n=7,143	Treated with IV t-PA ≤4.5 hours n=4,865	Percent treated with IV t-PA ≤4.5 hours %	Reporting Hospitals No.
2008	567	135	23.8	14
2009	708	290	41.0	23
2010	731	500	68.4	30
2011	826	619	74.9	32
2012	859	660	76.8	36
2013	1,026	768	74.9	40
2014	1,109	895	80.7	43
2015	1,317	998	75.8	44

Between 2008 and 2015, the number of participating hospitals reporting on this measure increased each year, from 14 in 2008 to 44 participating hospitals in 2015. The yearly percent trend ranged from a low of 23.8% in 2008 to 80.7% in 2014. Compared to the time to initiation of IV t-PA treatment of patients who arrive by 2 hours of time LKW (94.9%), a significant difference in time to initiation of treatment is seen for patients who arrive within 3.5 hours of time LKW (68.1%).

Improvement in the process of care, decreased arrival to treatment times, can potentially increase the odds of favorable health outcomes among a patient population that is already at an increased risk of poor health outcomes.

DRIP AND SHIP THERAPY

Drip and ship denotes ischemic stroke patients for which IV t-PA is initiated at the emergency department (ED) of a community hospital, then are transferred to a comprehensive stroke center. Among the eligible ischemic stroke patients, 1.9% had initiation of IV t-PA therapy at a community hospital ED (**Table 20**).

Table 20. Drip and Ship therapy among ischemic stroke patients, 2008-2015.

Ischemic stroke cases (N)	IV t-PA initiated at a community hospital (n)	Percent %
51,468	969	1.9

Figure 17 and **Table 21** represents the percentage of drip and ship therapy among ischemic stroke patients by year.

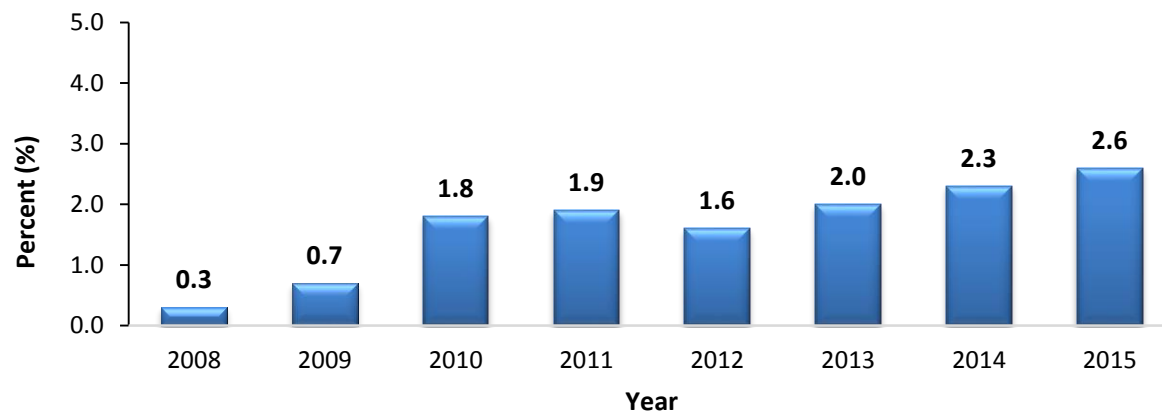


Figure 17. Drip and ship therapy among ischemic stroke patients, by year, 2008-2015.

Table 21. Drip and ship therapy among ischemic stroke patients, by year, 2008-2015.

Year	Ischemic stroke cases N=51,468	Drip & Ship cases n=969	Percent Drip & Ship cases %	Reporting Hospitals No.
2008	2,826	8	0.3	18
2009	3,680	27	0.7	25
2010	5,371	95	1.8	31
2011	6,136	117	1.9	34
2012	7,057	110	1.6	38
2013	7,871	160	2.0	40
2014	8,728	201	2.3	44
2015	9,799	251	2.6	44

Between 2008 and 2015, the number of hospitals reporting on this measure increased each year, from 18 to 44 participating hospitals in 2014 and 2015. The percent of eligible patients that receive IV t-PA in the ED of a community hospital prior to being transferred to a comprehensive stroke center ranged from a low of 0.3% in 2008 to a high of 2.6% in 2015. A slight, but continuous increase in the practice of drip and ship therapy is seen each year.

ENDOVASCULAR THERAPY

Endovascular therapy includes patients with a diagnosis of ischemic stroke that received IA catheter-based treatment either in the ED, as an in-patient, or outside of the treating hospital. Among the eligible ischemic stroke patients, 1.1% received IA catheter-based reperfusion either at the ED, as an in-patient or outside of the treating hospital (**Table 22**).

Table 22. Ischemic stroke patients that receive endovascular therapy, 2008-2015.

Ischemic stroke cases (N)	IA catheter-based reperfusion* (n)	Percent IA catheter-based reperfusion* %
51,468	582	1.1

*either at the ED, as an in-patient, or outside of the hospital.

Figure 18 and **Table 23** display the percent of ischemic stroke patients that received endovascular therapy by year.

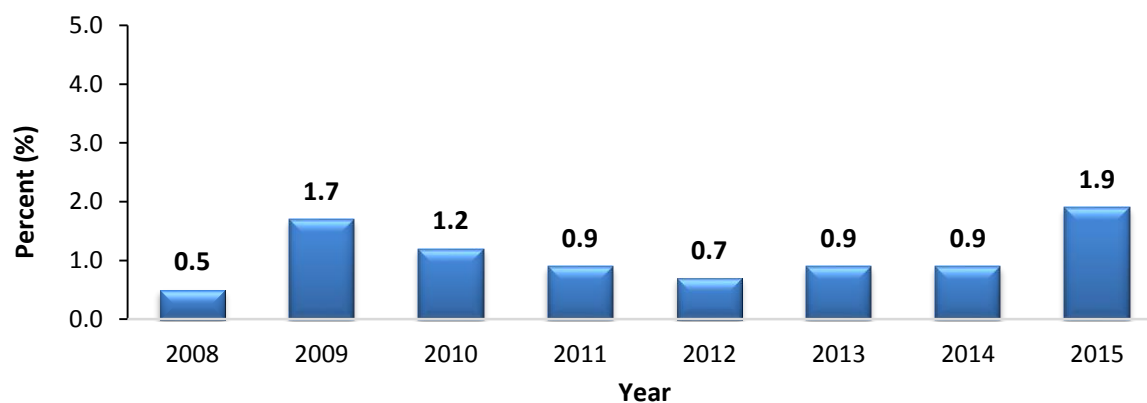


Figure 18. Endovascular therapy among ischemic stroke patients, by year, 2008-2015.

Table 23. Endovascular therapy among ischemic stroke patients, by year, 2008-2015.

Year	Ischemic stroke cases N=51,468	IA catheter-based reperfusion n=582	Percent IA catheter-based reperfusion %	Reporting Hospitals No.
2008	2,826	13	0.5	18
2009	3,680	61	1.7	25
2010	5,371	63	1.2	31
2011	6,136	57	0.9	34
2012	7,057	49	0.7	38
2013	7,871	74	0.9	40
2014	8,728	76	0.9	44
2015	9,799	189	1.9	44

Between 2008 and 2015, the number of hospitals reporting on this measure increased each year, from 18 in 2008 to 44 participating hospitals in 2014 and 2015. The percent of ischemic stroke patients who received endovascular therapy ranged from a low of 0.5% in 2008 to a high of 1.9% in 2015.

THROMBOLYTIC COMPLICATIONS

Thrombolytic complications describe patients with a diagnosis of acute ischemic stroke that experience bleeding complications after thrombolytic therapy was administered. Of the 51,468 acute ischemic stroke patients, 9.0% (5,743) received IV t-PA or IA catheter-based treatment from the treating hospital.

Among those acute ischemic stroke patients treated (5,743), 4.7% (269) experienced bleeding complications after IV t-PA or IA catheter-based treatment was administered (**Figure 19**).

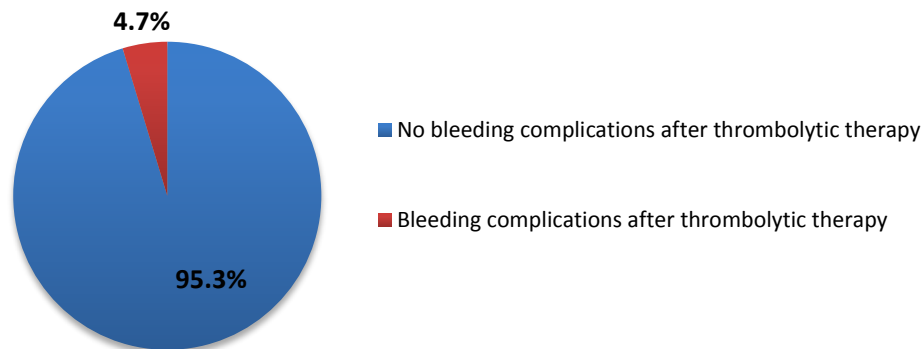


Figure 19. Percent of ischemic stroke patients with bleeding complications after thrombolytic therapy, 2008-2015.

Figure 20 and **Table 24** display the percent of ischemic stroke patients that experience bleeding complications after receiving thrombolytic therapy by year.

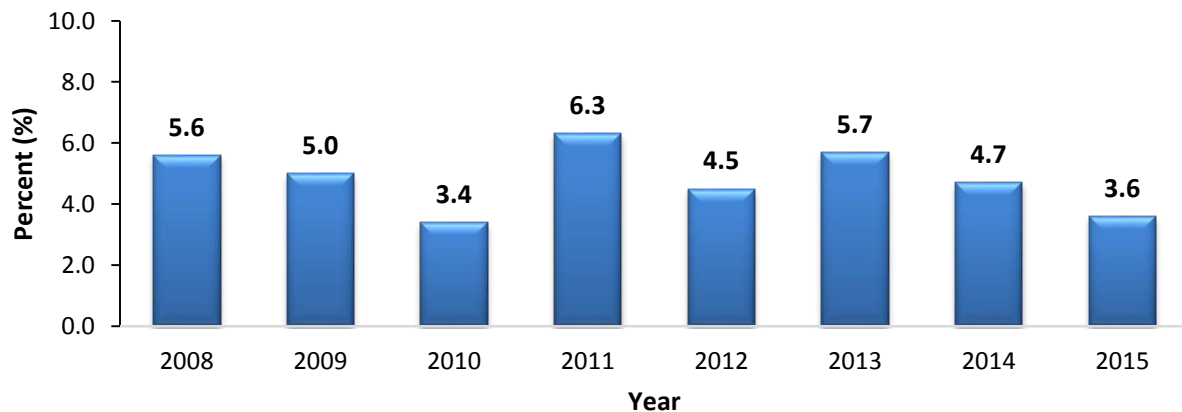


Figure 20. Ischemic stroke patients with bleeding complications after thrombolytic therapy, by year, 2008-2015.

Table 24. Ischemic stroke patients with bleeding complications after thrombolytic therapy, by year, 2008-2015.

Year	Ischemic stroke cases treated with thrombolytic therapy n=5,743	Bleeding complications after thrombolytic therapy n=269	Percent bleeding complications after thrombolytic therapy %	Reporting Hospitals No.
2008	143	8	5.6	11
2009	337	17	5.0	21
2010	580	20	3.4	29
2011	698	44	6.3	31
2012	739	33	4.5	36
2013	899	51	5.7	40
2014	1,052	49	4.7	44
2015	1,295	47	3.6	42

Between 2008 and 2015, the number of participating hospitals reporting on this measure increased, from 11 in 2008 to 44 in 2014. The reporting declined in 2015 to 42 hospitals. The percent of eligible patients who experienced bleeding complications post thrombolytic therapy ranged from a low of 3.4% in 2010 to a high of 6.3% in 2011.

REHABILITATION CONSIDERED

The severity and timely treatment of a stroke can affect health outcomes and recovery, including the stroke survivor's functionality in terms of speech, language, and physical ability.² In order to achieve the best results, physicians should assess all stroke patients for rehabilitative services.³

Among ischemic, hemorrhagic, TIA, and stroke NOS patients, 97.6% were assessed for rehabilitative services, while 2.4% of stroke patients were not considered for rehabilitative services (**Figure 21**).

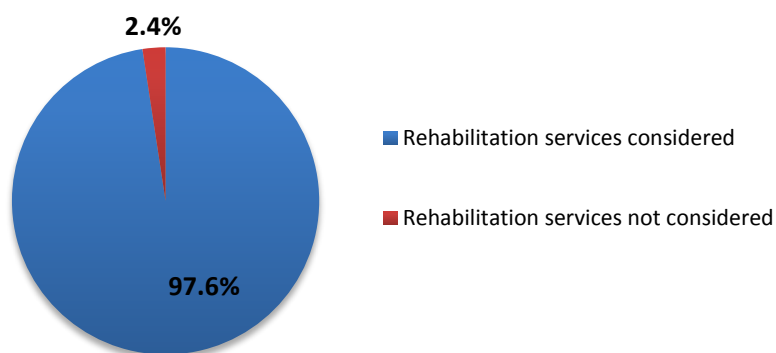
**Figure 21.** Percent of stroke patients assessed for rehabilitative services prior to discharge, 2008-2015

Figure 22 and **Table 25** display the percent of patients diagnosed with ischemic stroke, TIA, ICH, SAH, and stroke NOS that were assessed for rehabilitative services prior to hospital discharge by year.

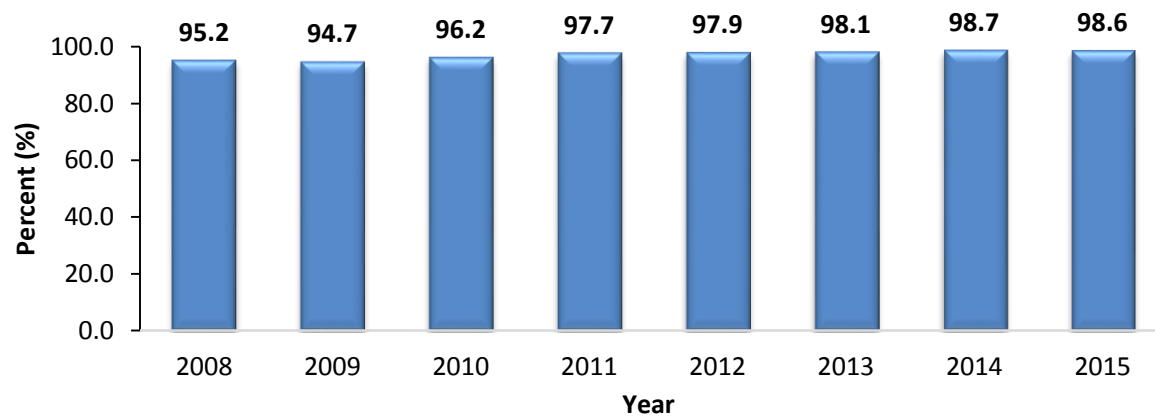


Figure 22. Stroke patients assessed for rehabilitative services prior to discharge, by year, 2008-2015.

Table 25. Stroke patients assessed for rehabilitative services prior to discharge, by year, 2008-2015.

Year	Stroke cases	Assessed for rehabilitation	Assessed for rehabilitation	Percent	Reporting Hospitals
	N=51,622	n=50,376		%	No.
2008	2,929	2,789		95.2	19
2009	3,986	3,774		94.7	25
2010	5,588	5,377		96.2	31
2011	6,225	6,084		97.7	33
2012	6,824	6,677		97.9	38
2013	7,652	7,506		98.1	41
2014	8,710	8,599		98.7	44
2015	9,708	9,570		98.6	44

Between 2008 and 2015, the number of hospitals reporting on this measure increased each year, from 19 in 2008 to 44 participating hospitals in 2014 and 2015. The percent of eligible patients who were assessed for rehabilitative services ranged from a low of 94.7% in 2009 to a high of 98.7% in 2014.

DISCHARGE DISPOSITION

The discharge disposition, or the plan for care after discharge from the hospital, can provide an indication of the severity and extent of disability of a stroke patient.

Among stroke patients discharged on or after April 1, 2011, more than half, 52.5% of stroke patients, were discharged to home and nearly one third, 32.9% were discharged to a healthcare facility (**Figure 23a**). Of those patients discharged to other healthcare facility, 58.4% were discharged to an inpatient rehabilitation facility (IRF), and 34.5% a skilled nursing facility (SNF) (**Figure 23b**).

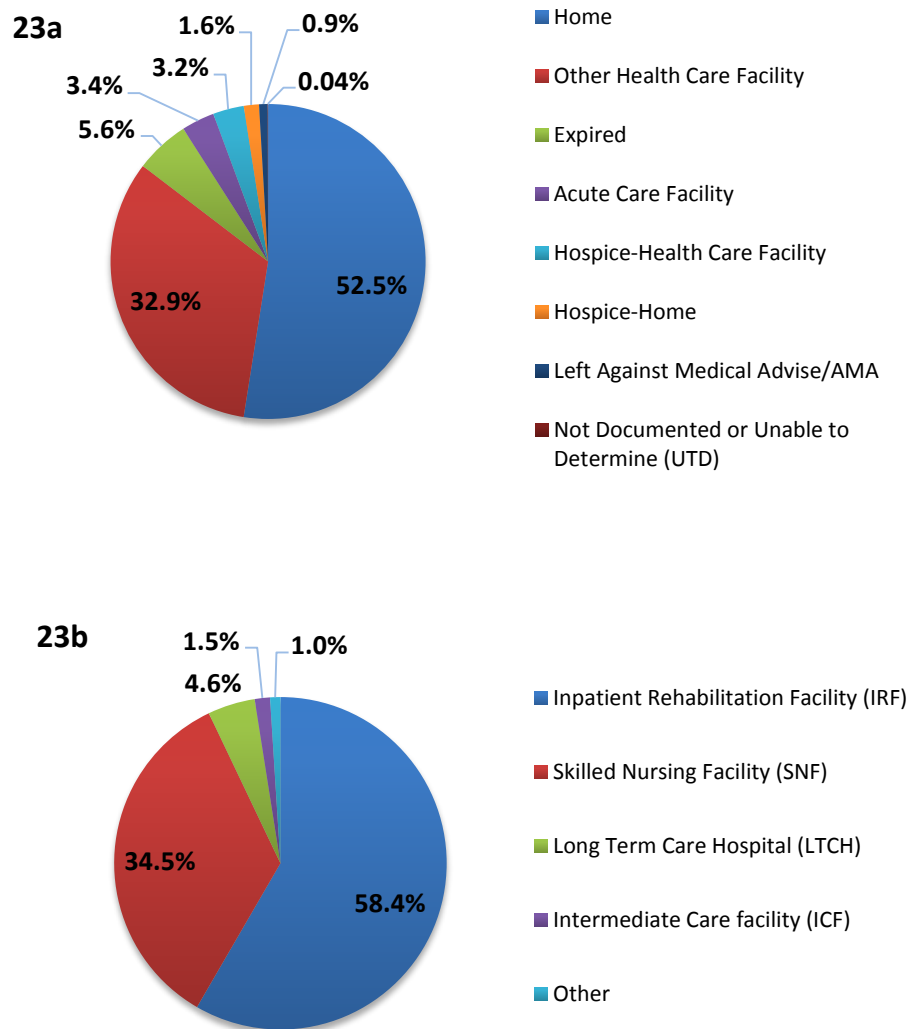


Figure 23a. Discharge disposition of stroke patients, discharged on or after April 1, 2011. **23b.** Discharge disposition among stroke patients discharged to *Other Healthcare Facility*.

Figure 24 and **Figure 25** displays the discharge disposition and type of healthcare facility stroke patients are discharge to from 2011 to 2015.

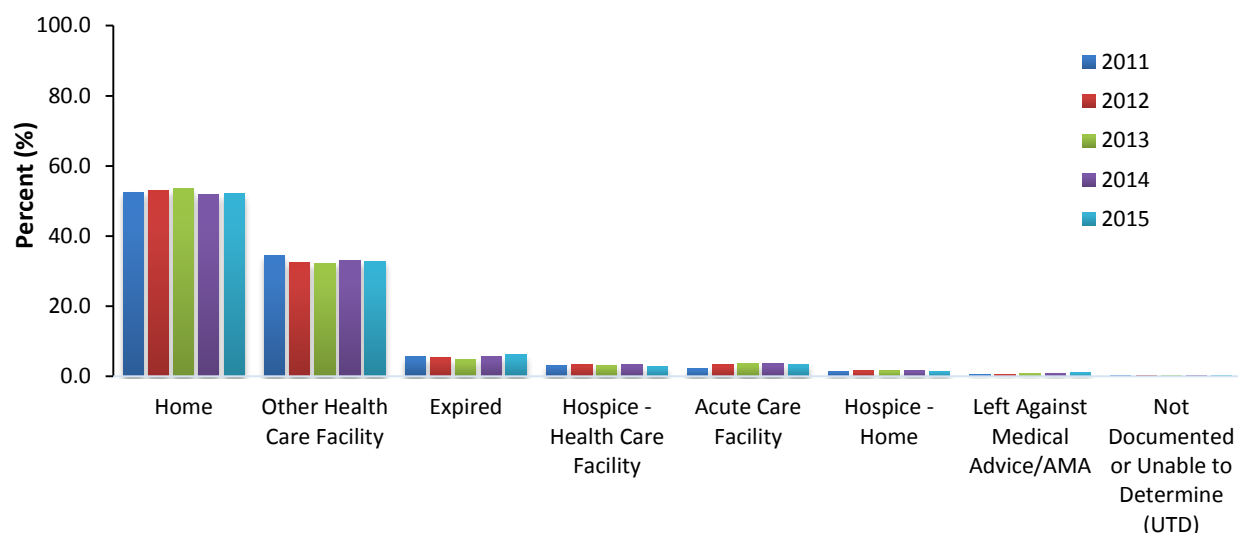


Figure 24. Discharge disposition of stroke patients, by year, 2011-2015.

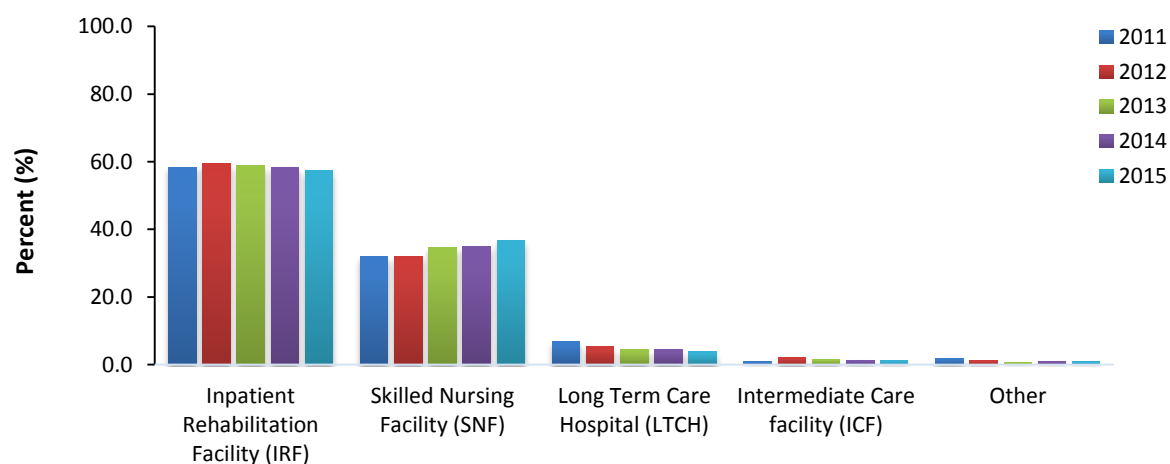


Figure 25. Discharge disposition among stroke patients discharged to *Other Healthcare Facility*, by year, 2011-2015.

Between 2011 and 2015, the number of hospitals reporting on this measure increased each year, from 34 to 44 participating hospitals reporting in 2014 and 2015. Opportunities may exist in determining if an association exists between patients discharge disposition, home versus other healthcare facility, and the stroke survivors' utilization of rehabilitative services.

COMORBIDITIES

The following figures display the prevalence of comorbid conditions, among patients with a diagnosis of ischemic stroke, transient ischemic stroke, intracerebral hemorrhage, subarachnoid hemorrhage, and stroke not otherwise specified from 2008-2015. Two different methods are used to estimate the prevalence of comorbidities among the stroke population; by the medical history reported by the patient or previously documented history, and by biomarkers measured during the stroke episode of care.

The following comorbidities are included in the report;

1. Atrial Fibrillation
2. Diabetes Mellitus
3. Lipid Measures – Total Cholesterol, LDL, HDL, and Triglycerides
4. Documentation of Lipid Profile
5. Dyslipidemia
6. Hypertension
7. Smoking
8. Overweight and Obesity

ATRIAL FIBRILLATION

Atrial fibrillation (AF) is thought to be the cause of approximately 10-12% of all ischemic stroke case in the United States.³ AF also increases the risk of stroke reoccurrence in patients with prior and/or recent ischemic stroke or TIA.

The prevalence of AF, reported as a previously known medical condition, among the stroke patient population is 65.6% (49,206) (**Figure 26**). Meaning, from 2008-2015, a total of 49,206 stroke cases had a documented medical history of AF.

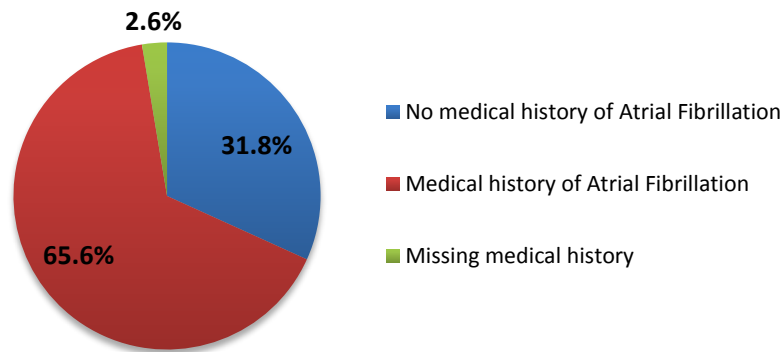


Figure 26. Medical history of atrial fibrillation, 2008-2015.

DIABETES MELLITUS

Diabetes mellitus is not only associated with an increased risk of initial ischemic stroke but also increases the risk of stroke reoccurrence after the first ischemic stroke is experienced.³

The prevalence of diabetes mellitus, reported as a previously known medical condition, among the stroke patient population is 39.6% (29,714) (**Figure 27**). Meaning, from 2008-2015, a total of 29,714 stroke cases had a documented medical history of diabetes mellitus.

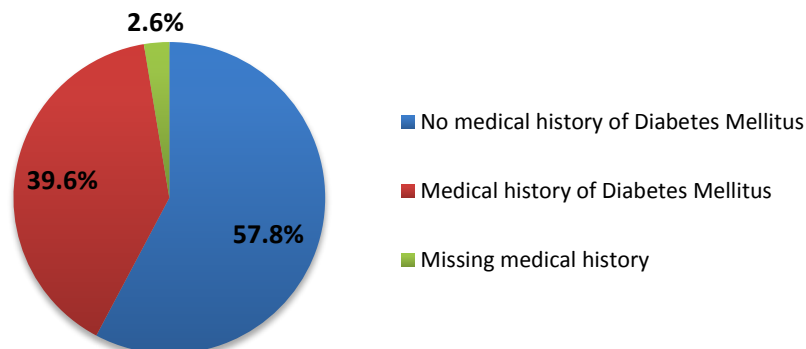


Figure 27. Medical history of diabetes mellitus, 2008-2015.

LIPID MEASURES – TOTAL CHOLESTEROL, LDL, HDL, TRIGLYCERIDES

Among all stroke patients; 67.5% (50,628) had a documented HDL <40 mg/dL, 19.5% (14,621) had a documented triglyceride level ≥ 150 mg/dL, 16.3% (12,219) had a documented LDL ≥ 130 mg/dL, and 14.1% (10,582) had a documented total cholesterol >200 mg/dL (**Figure 28**). The prevalence of these lipid measure categories are not mutually exclusive, and may not add up to 100%.

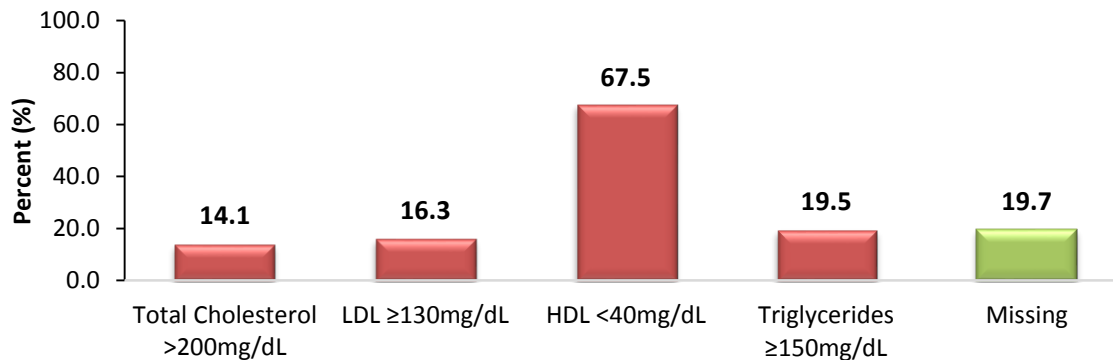


Figure 28. Prevalence of high risk lipid levels during the stroke episode of care, 2008-2015.

DOCUMENTATION OF LIPID PROFILE

Patients diagnosed with ischemic stroke and TIA should have a lipid profile measurement performed within 24-48 hours of hospital admission, unless documented results of lipid profile performed within the past 30 days exist in patient's medical record.³

Among eligible ischemic stroke and TIA patients, 66.8% had lipid results either documented and performed within 48 hours of hospital admission or were previously documented and performed within 30 days prior to hospital admission (**Figure 29**).

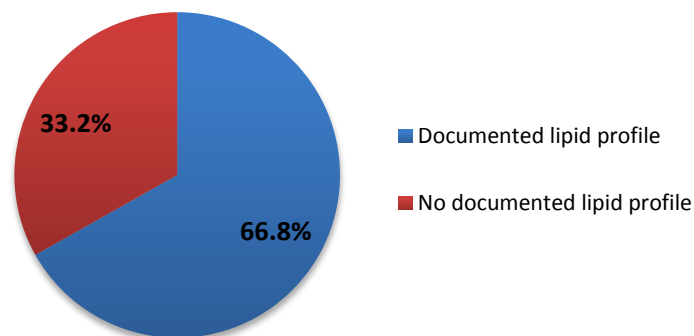


Figure 29. Ischemic stroke and TIA patients with a documented lipid profile, 2008-2015.

This indicates a potential gap in the stroke system of care. Opportunity exists in requiring standardized documentation of lipid profiles across all hospital systems in Texas.

DYSLIPIDEMIA

Serum lipid biomarkers; elevated triglyceride levels, low HDL, and high LDL, have been associated with an increased risk of stroke and is a primary component for preventing stroke reoccurrence.³

The prevalence of dyslipidemia, reported as a previously known medical condition, among the stroke patient population is 39.9% (29,911) (**Figure 30**). Meaning, from 2008-2015, a total of 29,911 stroke cases had a documented medical history of dyslipidemia.

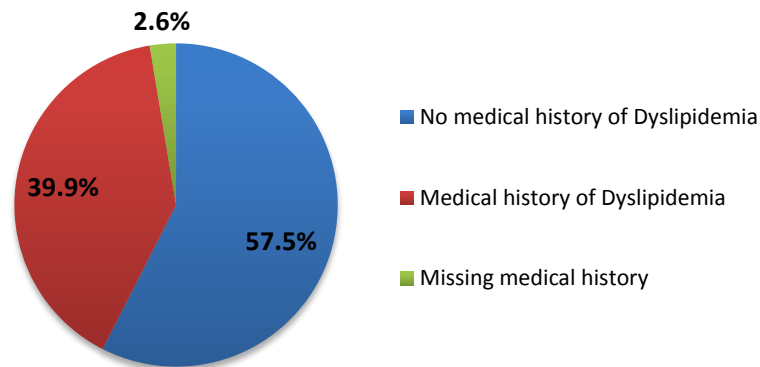


Figure 30. Medical history of dyslipidemia, 2008-2015.

Figure 31 displays the prevalence of dyslipidemia by the lipid results; total cholesterol >200 mg/dL, or LDL \geq 130 mg/dL, or HDL <40 mg/dL, performed within 48 hours of hospital admissions or the existing documented results of a lipid profile performed within the past 30 days.

The prevalence of dyslipidemia, reported as lipid levels within 48 hours of admission or within the prior 30 days, among the stroke patient population is 76.9% (57,678) (**Figure 31**). Meaning, from 2008-2015, a total of 57,678 stroke cases had a total cholesterol >200 mg/dL, or LDL \geq 130 mg/dL, or HDL <40 mg/dL.

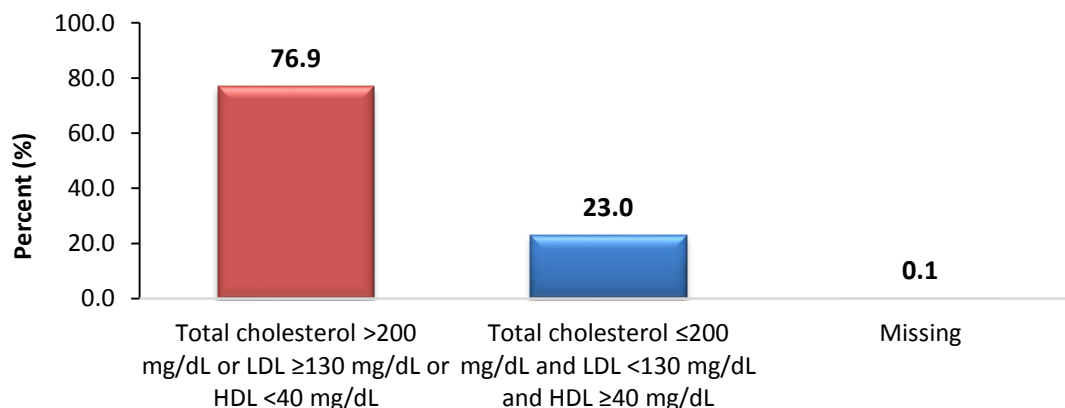


Figure 31. Prevalence of dyslipidemia during the stroke episode of care, 2008-2015.

HYPERTENSION

Treatment of hypertension is thought to be the most important intervention for secondary prevention of ischemic stroke.³ Though the relationship between hypertension and stroke recurrence has been less well studied, its importance in preventing recurrent stroke is thought to be of equal importance.³

The prevalence of hypertension, reported as a previously known medical condition, among the stroke patient population is 75.5% (55,605) (**Figure 32**). Meaning, from 2008-2015, a total of 55,605 stroke cases had a documented medical history of hypertension.

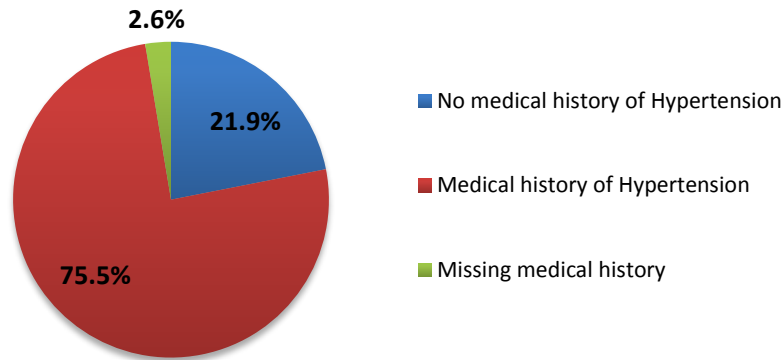


Figure 32. Medical history of hypertension, 2008-2015.

Figure 33 displays the proportion of stroke patients that have a documented blood pressure, and values include a systolic blood pressure (SBP) ≥ 140 mm Hg and/or a diastolic blood pressure (DBP) ≥ 90 mm Hg.

The prevalence of hypertension, reported as SBP and DBP documented during the stroke episode of care, among the stroke patient population is 49.6% (37,200) (**Figure 33**). Meaning, from 2008-2015, a total of 37,200 of the reported stroke cases had a documented SBP ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg during the stroke episode of care. The decrease in prevalence of hypertension from a previously known medical condition (75.5%) to the measured SBP and DBP (49.6%) values could reflect the management of hypertension during the stroke episode of care.

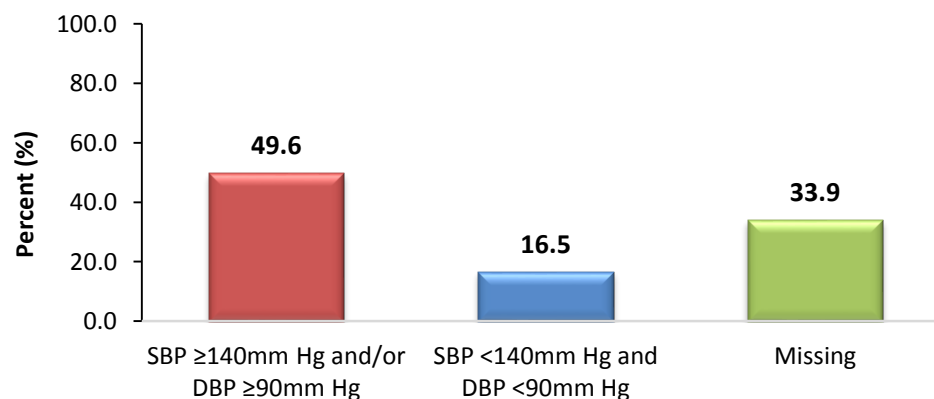


Figure 33. Prevalence of hypertension during the stroke episode of care, 2008-2015.

SMOKING

Tobacco use is the largest modifiable risk factor contributing to premature morbidity and mortality in Texas. Smoking cigarettes is an independent risk factor for first ischemic stroke and may nearly double an individual's risk of reoccurrence.³

The prevalence of smoking, reported as a previously known medical condition, among the stroke patient population is 24.7% (18,536) (**Figure 34**). Meaning, from 2008-2015, a total of 18,536 stroke cases had a documented medical history of smoking.

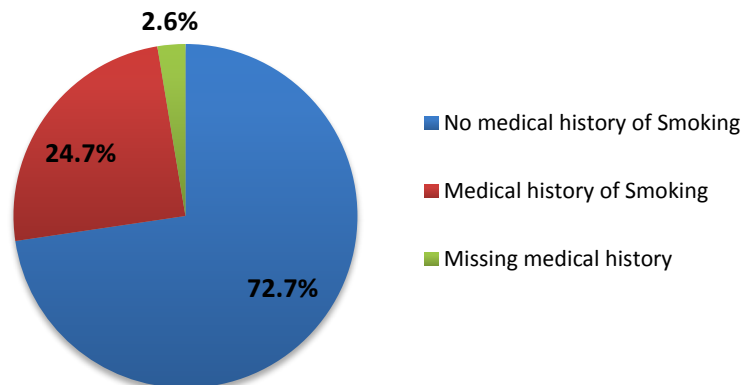


Figure 34. Medical history of smoking, 2008-2015.

SMOKING CESSATION

Healthcare providers should strongly advise every stroke patient who has smoked in the past year to quit to decrease the risk of recurrent stroke. Among the stroke patients with a history of smoking, and admitted to the hospital, 64.8% (11,499) received, or caregiver received, smoking cessation counseling prior to hospital discharge (**Figure 35**).

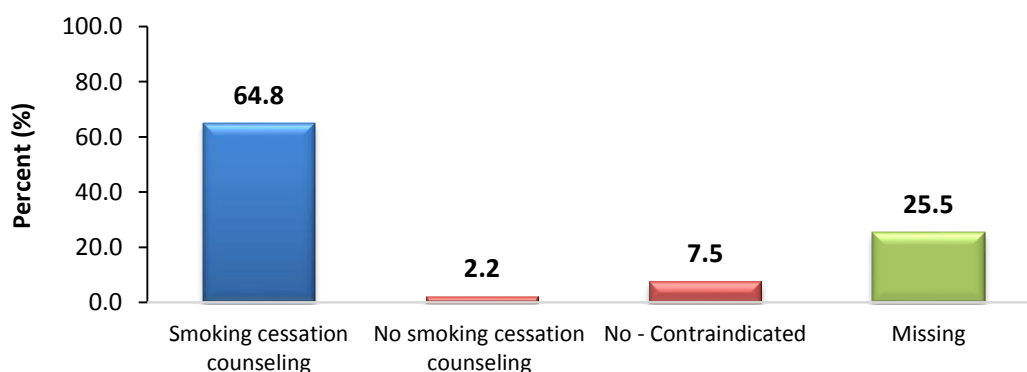


Figure 35. Stroke patients with a history of smoking that receive smoking cessation prior to discharge, 2008-2015.

Research indicates that stroke patients who receive even brief cessation advice from their healthcare provider are more likely to quit smoking than those receiving no counseling at all.³ Thus, opportunity for improvement exists.

OVERWEIGHT AND OBESITY

Overweight and obesity is associated with an increased risk of stroke, and thought to be linear in nature. For every $1\text{kg}/\text{m}^2$ increase in Body Mass Index (BMI) of $20\text{kg}/\text{m}^2$, the risk of stroke is increased by 5%.³

The prevalence of overweight/obesity, reported as a previously known medical condition, among the stroke patient population is 10.5% (7,850) (**Figure 36**). Meaning, from 2008-2015, a total of 7,850 stroke cases had a documented medical history of overweight/obesity.

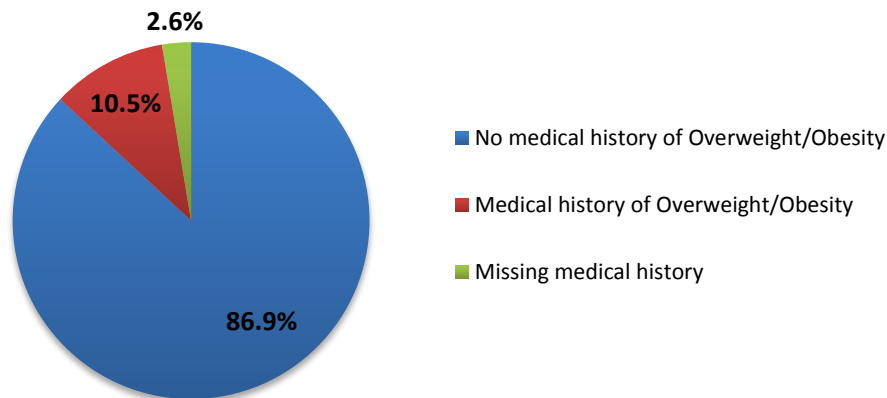


Figure 36. Medical history of overweight/obesity, 2008-2015.

Figure 37 displays the prevalence of overweight and obesity, $\text{BMI} \geq 25\text{kg}/\text{m}^2$, among stroke patients with a documented height and weight. The prevalence of overweight and obesity, reported as a $\text{BMI} \geq 25\text{kg}/\text{m}^2$ calculated from the patients height and weight during the stroke episode of care is 43.9% (32,924) (**Figure 37**). Meaning, from 2008-2015, a total of 32,924 reported stroke cases had a documented $\text{BMI} \geq 25\text{kg}/\text{m}^2$ during the stroke episode of care.

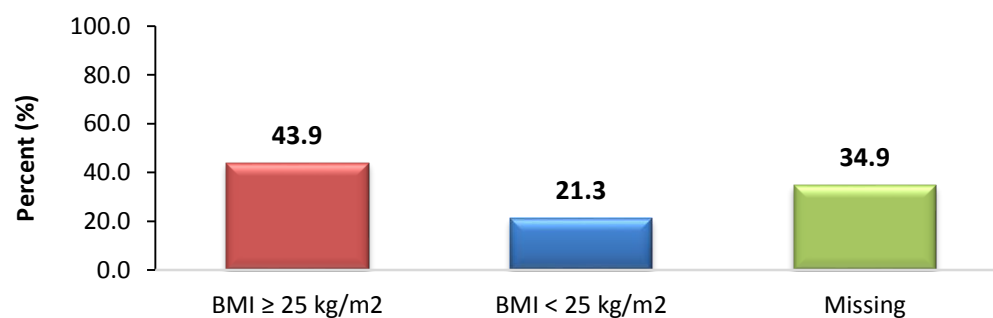


Figure 37. Prevalence of $\text{BMI} \geq 25\text{ kg}/\text{m}^2$ during the stroke episode of care, 2008-2015.

The significant difference between the medical history (10.5%) and the measured BMI (43.9%) values indicates the under-reporting of overweight/obesity. Although BMI is not reported for 34.9% (26,137) of patients, of them 4.9% (1,294) self-reported a medical history of overweight/obesity. Furthermore, 80.3% (26,427) of the patients with a $\text{BMI} \geq 25\text{ kg}/\text{m}^2$ self-reported no medical history of overweight/obesity.

APPENDIX

INCLUSION/EXCLUSION CRITERIA FOR PREHOSPITAL MEASURES

EMS RUN

The following is the inclusion criteria used to define the total number of EMS runs included in the report;

- Incident state; Texas
- Age; ≥18 years
- Run type; 911 response

POSSIBLE STROKE RUN

For the purpose of this report a run was considered a possible stroke run if the following criteria in addition to the above inclusion criteria, was met;

- Primary Symptom; Stroke/Cerebrovascular Accident

URBAN-RURAL CLASSIFICATION FOR PREHOSPITAL MEASURES

The Texas Department of State Health Services (DSHS) follows the Metropolitan and Non-Metropolitan county designations defined by the U.S. Office of Budget and Management (OBM). In Texas, 82 counties are designated as Metropolitan and 172 are designated as Non-Metropolitan. The terms “Non-Metropolitan and Metropolitan” and interchangeable with “Urban and Rural.” <https://www.dshs.texas.gov/chs/hprc/counties.shtm>

The following are definitions used specifically for this report. The urban and rural categories used are defined based upon the 2013 National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme for Counties. This includes six county-level categories: metropolitan (large central metro, large fringe metro, medium metro, and small metro) and nonmetropolitan (micropolitan and noncore).

URBAN COUNTY

- Large central metro—counties in metropolitan statistical areas (MSA) of 1 million or more population that: contain the entire population of the largest principal city of the MSA, or have their entire population contained in the largest principal city of the MSA, or contain at least 250,000 inhabitants of any principal city of the MSA.
- Large fringe metro—counties in MSAs of 1 million or more population that did not qualify as large central metro counties.
- Medium metro—counties in MSAs of populations of 250,000 to 999,999.
- Small metro—counties in MSAs of populations less than 250,000.

RURAL COUNTY

- Micropolitan—Counties in micropolitan statistical areas.
- Noncore—Nonmetropolitan counties that did not qualify as micropolitan.

TABLE DATA SOURCES

Table 1. Estimated number and unadjusted prevalence of adults, 18 years and older, that report ever having had a stroke in Texas, by race/ethnicity, 2011-2014. (Pg. 8)

Data source: Texas Behavioral Risk Factor Surveillance System (2011, 2012, 2013, 2014).

Table 2. Age-adjusted stroke hospitalization rate (per 10,000), all ages, in Texas, by race/ethnicity, 2008-2013. (Pg. 8)

Data source: 2013 Texas Vital Statistics, Population Data; (2) 2013 Texas Vital Statistics, Mortality Data.

Table 3. – Table 9. PRE-HOSPITAL MEASURES FOR STROKE IN TEXAS (Pgs. 11-13)

Data Source: Texas EMS & Trauma Registries (2014) Texas Department of State Health Services.

Table 10. – Table 25. EVALUATING HOSPITAL CARE FOR STROKE IN TEXAS (Pgs. 14-34)

Data Source: This Get With The Guidelines® Aggregate Data report was generated using the Quintiles PMT® system. Copy or distribution of the Get With The Guidelines® Aggregate Data is prohibited without the prior written consent of the American Heart Association and Quintiles.

FIGURE DATA SOURCES

Figure 1. The 2009-2013, average age-adjusted number of deaths due to stroke per 100,000 people, all ages, by county, in Texas. (Pg.9)

Data source: County-level mortality data, 2009-2013, and County-level population data, 2009-2013; Texas Department of State Health Services, Center for Health Statistics, Austin, Texas.

Figure 2. PRE-HOSPITAL MEASURES FOR STROKE IN TEXAS (Pg.10)

Data Source: Texas EMS & Trauma Registries (2014) Texas Department of State Health Services.

Figure 3. – Figure 37. EVALUATING HOSPITAL CARE FOR STROKE IN TEXAS (Pgs. 17-41)

Data Source: This Get With The Guidelines® Aggregate Data report was generated using the Quintiles PMT® system. Copy or distribution of the Get With The Guidelines® Aggregate Data is prohibited without the prior written consent of the American Heart Association and Quintiles.

REFERENCES

1. American Heart Association. (2012). *Types of stroke*. Retrieved from http://www.strokeassociation.org/STROKEORG/AboutStroke/TypesofStroke/Types-of-Stroke_UCM_308531_SubHomePage.jsp
2. Jauch, E.C., Saver, J.L., Adams, H.P., Bruno, A., Connors, J.J., Demaerschalk, B.M. ,...Yonas, H. (2013). Guidelines for the early management of adults with ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, 2013(44):870-947.
3. Kernan, W.N., Ovbiagele, B., Black, H.R., Bravata, D.M., Chimowitz, M.I., Ezekowitz, M.D.,...Wilson, J.A. (2014). Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, 2014(45): 2160-2236.